

THE FUTURE OF STREETS IN AN AGE OF PANDEMICS

A Dissertation
Presented to
The Academic Faculty

by

Deborah Elizabeth Postma

In Partial Fulfillment
of the Requirements for the Degree
Master of Science in Civil Engineering in the
School of Civil and Environmental Engineering and
Master of City and Regional Planning in the
School of City and Regional Planning

Georgia Institute of Technology
December 2020

COPYRIGHT © 2020 BY DEBORAH POSTMA

THE FUTURE OF STREETS IN AN AGE OF PANDEMICS

Approved by:

Dr. Michael Elliott, Advisor
School of City and Regional Planning
Georgia Institute of Technology

Dr. Kari E Watkins
School of Civil and Environmental Engineering
Georgia Institute of Technology

Dr. Michael Hunter
School of Civil and Environmental Engineering
Georgia Institute of Technology

Date Approved: December 4, 2020

To those who have ever safely enjoyed walking or biking anywhere.

ACKNOWLEDGEMENTS

I would like to thank Dr. Elliott, Dr. Watkins, and Dr. Hunter for serving as my committee members. I am thankful for their support and encouragement during my graduate studies.

I would like to especially thank Dr. Elliott for meeting with me almost bi-weekly for a BlueJeans chat, where he helped me stay on track, but also told me stories of Maine. He is sometimes better at organization my thesis thoughts than I am and always stretched my perspective that extra bit. From him, I have also learned the value of following-up in emails and general communication. I would like to thank Dr. Watkins for being an inspiration to me throughout my graduate years with her positivity, passion for bicycle and transit topics, and being a general powerhouse. Working on any project with her or sitting in her class is a joy. I would like to thank Dr. Hunter for teaching me more about rural congestion than I ever knew existed and for giving me odds-and-ends projects which helped and taught me throughout graduate school.

Lastly, I would like to acknowledge all my friends in graduate school, especially those in the big SEB graduate room who made staring at computer screens all day more fun. I wish we could have finished the semester together at real school.

Rupert, my not-my-cat cat, thank you for keeping me company during my thesis and especially for sitting on my keyboard, mouse, or arm while I was trying to work. You gave me more excuses to stop working and to look out the window, and for that I am ever grateful. You are right: there is nothing more important than petting a meow-ing cat.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	iv
LIST OF TABLES	vii
LIST OF FIGURES	viii
LIST OF SYMBOLS AND ABBREVIATIONS	xi
SUMMARY	xii
CHAPTER 1. Introduction	1
CHAPTER 2. Literature Review	5
2.1 How Pandemics Have Historically Changed Cities	5
2.2 Phasing and Interim Strategies: Tactical Urbanism	6
2.2.1 Types of Tactical Urbanism	7
2.3 Transportation Resources Relating to Pandemic Responses	9
2.4 Equity Nuances of Open Street Policies during Covid-19	12
2.4.1 Guiding Principles of Covid-19 Response and Recovery	14
2.5 Types of Transportation Responses to Covid-19	18
2.5.1 Overview of Specific Covid-19 Transportation Responses	32
2.6 Summary of Literature Review	34
CHAPTER 3. Research methodology	35
3.1 Objectives	35
3.2 Methodology	36
3.2.1 Case Study Interview Questions	37
CHAPTER 4. Transportation Responses to Covid-19: A Characterization and Future Implications	39
4.1 Organization of Results	39
4.2 Case study: San Francisco	40
4.2.1 Transportation Response Overview	40
4.2.2 Initiating Factors in Covid-19 Transportation Response	42
4.2.3 Logistics of Projects	43
4.2.4 Feedback to and Future of Responses	46
4.2.5 Equity	47
4.3 Case study: Portland	53
4.3.1 Transportation Response Overview	53
4.3.2 Initiating Factors in Covid-19 Transportation Responses	54
4.3.3 Logistics of Projects	56
4.3.4 Feedback to and Future of Responses	59

4.3.5	Equity	60
4.4	Case study: Seattle	64
4.4.1	Transportation Response Overview	64
4.4.2	Initiating Factors in Covid-19 Transportation Responses	68
4.4.3	Logistics of Projects	69
4.4.4	Feedback to and Future of Responses	71
4.4.5	Equity	74
4.5	Case Study: Toronto	78
4.5.1	Transportation Response Overview	78
4.5.2	Initiating Factors in Covid-19 Transportation Response	81
4.5.3	Logistics of Projects	82
4.5.4	Feedback to and Future of Responses	84
4.5.5	Equity	86
4.6	Summary of Results	89
4.7	Discussion of Results	92
CHAPTER 5.	Conclusions	98
REFERENCES		100

LIST OF TABLES

Table 1	List of general interview questions asked to all case study cities.	37
Table 2	Comparison of San Francisco's Equity Areas to Covid-19 transportation responses.	50
Table 3	Comparisons of Portland's Equity Areas to Covid-19 transportation responses.	62
Table 4	Comparison of Seattle's Equity Areas to Covid-19 transportation responses.	76
Table 5	Comparison of Toronto's Equity Areas to Covid-19 transportation responses.	87
Table 6	Summary table of Case Study Cities.	89
Table 7	Summary of all case study city comparisons of Covid-19 transportation responses to Equity Areas.	91

LIST OF FIGURES

Figure 1	Swedish illustration depicting the unequal proportions of a normal urban street corner. (Karl Jilg/ Swedish Road Administration)	1
Figure 2	Rethinking streets during physical distancing. (NACTO Streets for Pandemic Response and Recovery, pg 6-7)	11
Figure 3	Types of policies to consider, based on stage of pandemic and the type of street. (NACTO Streets for Pandemic Response and Recovery)	17
Figure 4	Bike/ roll lanes. (NACTO Streets for Pandemic Response and Recovery)	20
Figure 5	Minneapolis added 11 miles of bike lanes in order to allow a safe space for biking and rolling while maintaining physical distancing. (NACTO Streets for Pandemic Response and Recovery)	21
Figure 6	Sidewalk extension. (NACTO Streets for Pandemic Response and Recovery)	22
Figure 7	Examples of sidewalk extensions in Milan and Brookline. (NACTO Streets for Pandemic Response and Recovery)	23
Figure 8	Transit lane. (NACTO Streets for Pandemic Response and Recovery)	24
Figure 9	Slow or shared streets. (NACTO Streets for Pandemic Response and Recovery)	25
Figure 10	Shared street example in Oakland, CA. (NACTO Streets for Pandemic Response and Recovery)	26
Figure 11	Pickup and delivery zones. (NACTO Streets for Pandemic Response and Recovery)	27
Figure 12	Outdoor dining. (NACTO Streets for Pandemic Response and Recovery)	28
Figure 13	Example of outdoor dining expanded to the streets in Tampa, FL. (NACTO Streets for Pandemic Response and Recovery)	29
Figure 14	Outdoor markets with expanded space. (NACTO Streets for Pandemic Response and Recovery)	30

Figure 15	Example of expanded outdoor market in Kalaw, Myanmar. (NACTO Streets for Pandemic Response and Recovery)	31
Figure 16	Pedestrian signal button automated in Providence, RI. (City of Providence)	32
Figure 17	Slow Street on Halloween. (@jeffreytumlin)	40
Figure 18	Shared space for dining in the Sunset district. (@jeffreytumlin)	42
Figure 19	Slow Street on Noe Street, designated by Road Closed sign. (@jeffreytumlin)	45
Figure 20	GIS equity map. San Francisco's Slow Streets mapped alongside of existing bike facilities and compared to vulnerable areas, as designated by the City of San Francisco.	51
Figure 21	SFMTA's map of Slow Streets showing where outreach will focus for Phase 4 to see if there is interest and support for Slow Street corridors here. (SFMTA, Slow Streets Takes it to the Streets.)	52
Figure 22	Slow Street in Portland, Oregon. (@bikeportland)	53
Figure 23	Intersection sidewalk extension in Portland using simple paint and barriers. (@PBOT)	55
Figure 24	Outdoor dining street closure and elimination of a crosswalk and therefore crosswalk queuing. (@PBOT)	58
Figure 25	GIS equity map. Portland Greenway Advisory Signs, indicating where the Covid-19 greenway responses are, mapped alongside of vulnerable areas and the bike network.	63
Figure 26	Stay Healthy Street, one of Seattle's newly upgraded Neighborhood Greenway. (@SDOTPhotos)	65
Figure 27	Stay Healthy Block in Seattle. (@SeattleDOT)	66
Figure 28	Sidewalk extension serving as a curbside cafe. (@SeattleDOT)	67
Figure 29	Outdoor dining extension into a parking lane in Seattle. (@SDOTPhotos)	71
Figure 30	A creative winter outdoor dining solution in Seattle. (@MinusPeach)	73
Figure 31	GIS equity map. Seattle's KMS and SHS mapped alongside of the Racial and Social Equity Index, as designated by the City of Seattle.	77

Figure 32	Toronto's Quiet Street. (@OurGreenway)	79
Figure 33	Accelerated temporary bike lane in Toronto. (@TO_Transport)	80
Figure 34	Toronto seeking feedback to ActiveTO through sidewalk signs. (@TO_Cycling)	85
Figure 35	GIS equity map. Toronto's Quiet Streets and Major Road Closures mapped alongside of vulnerable neighborhoods, as designated by the City of Toronto, and existing bike facilities.	88

LIST OF SYMBOLS AND ABBREVIATIONS

ABC	Atlanta Bicycle Coalition
BRT	Bus Rapid Transit
CDC	Center for Disease Control and Prevention
CEQA	California Environmental Quality Act
DSA	Downtown Seattle Association
GDCI	Global Designing Cities Initiative
Muni	San Francisco Municipal Railway
NACTO	National Association of City Transportation Officials
IIN	Invest In Neighborhoods
OEWD	Office of Economic and Workforce Development
PBOT	Portland Bureau of Transportation
PLI	Pedestrian Leading Interval
ROW	Right of Way
SDOT	Seattle Department of Transportation
SFMTA	San Francisco Municipal Transportation Agency
TNC	Transportation Network Company
TTS	Toronto Transportation Services

SUMMARY

There is not a place unaffected by the Covid-19 pandemic. In response to the pandemic, with its recommended public health social distancing guidelines of six feet, city transportation agencies have repurposed street space for residents to safely travel and recreate outside. At the same time, transportation agencies have become essential in partnering with local businesses in their expansion of dining space into public right-of-way space: sidewalks, parking lanes, and vehicular lanes. City agencies have had to adapt, evolve, and respond quickly to the current pandemic in order to effectively provide residents and businesses the ability to safely go outside and to continue some level of business.

The work presented in this thesis includes a quantitative and qualitative analysis of city transportation agency responses to Covid-19. San Francisco, Portland, Seattle, and Toronto serve as case study cities. Interviews were conducted with relevant city personnel from each city in order to gain a nuanced and detailed understanding of how cities are responding, what factors instigated responses, how project logistics differ under a pandemic, and how vulnerable populations were supported by these responses.

The researcher found that all cities studied had a prior inclination to people-friendly projects, that approval and outreach processes were bypassed in order to respond quickly to Covid-19, that certain projects will become permanent, and others have the potential to do so, and that project success is often context and locality specific. The equity maps demonstrate that there is much more work to be done to support vulnerable populations.

CHAPTER 1. INTRODUCTION

Transportation planners and engineers often contend with the widespread precedent of giving away public city space to people driving and parking their vehicles. The average car sits empty when it is driven by a single person, and downtowns, on average, give 50-60% of their scarce space to vehicles¹. The Covid-19 pandemic has further helped to highlight how we have allocated our streets in the United States. The cartoon in **Figure 1** shows a normal urban street corner with the space dedicated to cars removed. This illustrates how our streets look to those not in cars, where pedestrians are forced to compete for what little space remains. The discrepancy in space allocated to vehicles versus pedestrians is stark.

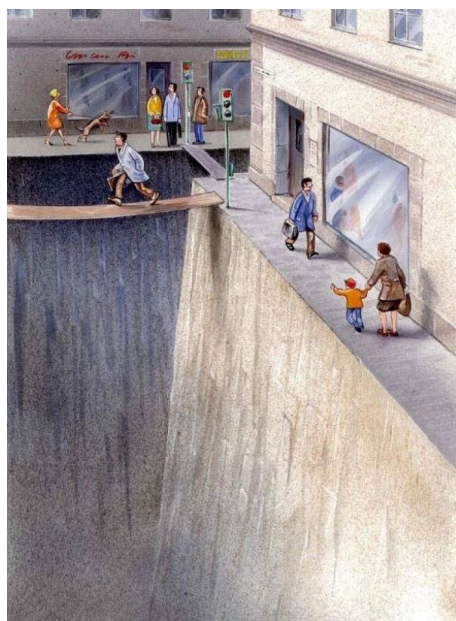


Figure 1. Swedish illustration depicting the unequal proportions of a normal urban street corner. (Karl Jilg/ Swedish Road Administration)

At the beginning of the current airborne pandemic, cities initially mandated lockdowns in order to slow the spread of the virus and to help limit hospital admissions from exceeding their supply of ICU beds. As it became clear Covid-19 would continue to affect cities for a long, unknown length of time, city personnel eased their lockdown guidelines and started allowing non-essential businesses, such as restaurants and retail stores to reopen with varying mask or person-limit guidelines. People who were able to work from home started to, and schools closed or went virtual, leaving parents to fend for their children and jobs all under the same roof. City agencies recognized that people needed outdoor space to safely travel and recreate outside.

As research emerged indicating that outdoor transmission of the virus was much less than indoor transmission², it became even more essential for cities to create safe places outside. Deemed “social distancing,” CDC guidelines recommend that people keep 6 feet apart to help control the spread of Covid-19². This distance is oftentimes impossible to keep on sidewalks that are sometimes less than 6 feet wide. People are forced to step into parking or travel lanes in order to maintain the appropriate distance. Exacerbating the space issue is the increased recreation demand for outdoor space: gyms were either closed, or people did not feel safe spending a concentrated amount of time indoors. Additional outside pedestrian demand stems from those now working or studying from home needing to escape their homes for some fresh air and change of scenery in the absence of other safe places to go during a global airborne pandemic.

Thus, cities have responded in various ways in order to better equip their residents with the space necessary to stay safe during the pandemic. Some cities have responded with temporary, and even permanent, street closures in order to better allocate space to

pedestrians. Other cities have altered their pedestrian push buttons so that a crosswalk light automatically signals for pedestrians without the button being pushed. Additionally, cities have put into place new protected or conventional bike lanes, either by expediting those already planned or by deciding to put in additional lanes. Some cities have allowed restaurants to expand dining to wide sidewalks and parking spaces without having to obtain a permit first.

Various aspects of a city, such as a city's prior inclination for people-friendly projects, could contribute to whether a city has initiated transportation responses to Covid-19. In initiating Covid-19 transportation responses, city planners and engineers have had to act quickly; thus, some of the typical approval and outreach processes have been altered, and this serves as a learning process for both city agencies and residents alike. The kinds of people-oriented projects that have been accelerated during Covid-19 could catalyze city planners and engineers to continue adding people-friendly elements to their projects. Of equal importance is where the responses are taking place and whether responses are occurring in neighborhoods with vulnerable populations. By characterizing cities' different responses to COVID-19, planners, engineers, and city officials can see limits and strengths of responses and how these responses relate to creating a just and equitable transportation system.

Streets have always been a public health issue, but this point is illuminated especially during a time when people need more outdoor space to protect their own health and that of others. As Covid-19 spreads across the entirety of the world, cities have quickly adapted their streets to give more space to people walking and biking. Eventually, people will become vaccinated and start to enter a post-Covid-19 world. What this world looks

like will be shaped by decisions that are made by planners and engineers right now. There is current momentum to direct a greater proportion of our city streets into equitable, safe, and people-friendly places.

CHAPTER 2. LITERATURE REVIEW

This literature review consists of five main topics: 1) how pandemics have historically changed cities, 2) tactical urbanism, 3) Covid-19 resources relating to transportation responses, 4) equity nuances and guiding principles of open street policies during Covid-19, and 5) types of transportation responses to Covid-19. The review finishes with a summary that synthesizes the topics into the most pertinent information for this thesis.

2.1 How Pandemics Have Historically Changed Cities

Pandemics have, for centuries, shaped cities, often changing them for the better. For instance, in 1793, garbage removal and sanitation departments were initiated during the yellow fever outbreak in Philadelphia³. Then in the 1850s, when cholera swept through American cities due to contaminated water, cities started creating public health and urban planning agencies. Eventually, water sanitation systems were developed to remove wastewater from urban areas, to isolate drinking water from wastewater, and eventually to treat both wastewater and drinking water to remove contaminations. At the same time, Central Park, the nation's first public park was created, as the city thought that open urban space improved human and environmental health.

However, eight of the ten most recent pandemics have been airborne³. Airborne transmission is curbed by reducing human-human contact and shelter-in-place orders. Lockdowns and the ability to provide adequate physically distant space to prevent transmission has proven difficult, especially over the long term, as lockdowns are crippling not only economically but also mentally. Thus, policymakers have been searching for

longer-term ideas³ in order to withstand the amount of time a pandemic, such as Covid-19, can affect a city. Some of these ideas center on streets and creating more space for people to safely recreate, dine, and travel in the right-of-way which is usually vehicular dominated. Some of the accommodations which are made during Covid-19 may end up benefiting all future residents of cities, depending on how each city progresses with their city responses to Covid-19.

2.2 Phasing and Interim Strategies: Tactical Urbanism

The type of temporary street projects which have been accelerated during Covid-19 are not unique to the current pandemic or pandemics generally. Cities have been using interim projects for years. These projects frequently serve as a first phase in making permanent changes to a city. By using temporary or inexpensive materials, citizens can see what a project will be like on a real, instead of imagined level. This allows a participatory process where people can react to projects while also allowing planners and engineers to adapt their plans from lessons learned. This type of process also fosters trust among different interest groups and community leaders⁴.

These temporary projects are often referred to as “tactical urbanism.” Tactical urbanism is defined as the act of “repurposing underutilized places using temporary materials and transforming them into more dynamic public spaces,” usually built on the premise that the temporary nature of tactical urbanism can help garner public engagement and support for permanent projects without initial the commitment or large expenses of permanent projects⁵. Types of project that utilize tactical urbanism often include repurposing streets as parks, plazas, transit streets, and gardens. In fact, the current

pedestrian-centric Times Square in New York City started with temporary measures: street closures, paint, and inexpensive beach chairs⁵.

Although tactical urbanism can technically be applied to any place, compact cities and towns, as opposed to sprawling places, consistently serve as the best examples of tactical urbanism⁴. Denser places possess a latent structure for tactical urbanism, often featuring undervalued and/or underutilized street space.⁴ As a note, more sprawling and auto-dependent environments could benefit from initially starting with slightly different design techniques as put forth in the *Sprawl Repair Manual* and *Retrofitting Suburbia* in dealing with “America’s unwalkable suburbs⁴.”

2.2.1 Types of Tactical Urbanism

The nature of a street changes as a community’s values, population, and preferences change. Therefore, the original roadway design and geometry may no longer serve a community effectively. Tactical urbanism often addresses issues such as roadway retrofits and urban traffic calming⁶. In order to test out different ideas, inexpensive, easily deployable, and temporary materials are used. Some of these materials include modular curbs, flexible bollards, paint and thermoplastic striping, planters, and temporary site interventions.

Tactical urbanism often involves “moving the curb” because curbs are the dividing line between pedestrians and other modes of transport. Repurposing and rethinking the curb can help balance all the users of the street in a more equitable way. Some ways to rethink the curb involve parklets (a sidewalk extension serving as a mini-park), sidewalk widening, intersection redesign, traffic calming, cycle corrals, and vendors/food trucks⁶.

Tactical urbanism projects range from unsanctioned to sanctioned projects. Unsanctioned projects refer to a type of “guerilla” tactical urbanism, meaning that ordinary citizens take to the streets without city approval in order to bring an idea to life. Oftentimes, projects start as unsanctioned and eventually move to sanctioned projects because of their level of success⁴.

“Open streets” initiatives are sanctioned projects and refer to the temporary closure of streets to automobile traffic and the opening of them to people for walking, biking, skating, dancing, and any other physical activity⁶. Funding can be public, private, or a partnership of the two. Settings can differ, as open street routes can be in a park, parkway, residential neighborhood, neighborhood center, or downtown. Other unique factors are route length, supporting activities, season, and frequency⁶. Cross-sector collaboration is essential to open streets, as 45% of initiatives are organized by a public entity, and 52% are funded by a public-private partnership⁶. **“Play streets”** are like open streets, except that they occur on a smaller scale, led by neighborhood and block association advocates, while open streets are led by city departments, politicians, advocates and non-profits. Play streets repurpose the street’s right of way for recreational activities⁴.

“Park(ing) day” is an annual event where on-street parking spaces are transformed into tiny parks and public spaces. Parking day highlights the amount of space which is given to storing private cars and encourages collaborative efforts amongst citizens⁴. **“Pavement to parks”** or **“parklets”** reclaim underutilized pavement as public space, often painting asphalt and adding sitting-spaces and planters⁴. **“Pop-up cafes”** refer to using parking spaces for tables and chairs in order to expand outdoor public seating and promote local businesses⁴. These are especially popular during warmer months and are

often leased from the planning department, with the business covering the design, construction, and maintenance costs. Restaurants often expand their seating outside, but do not limit their outdoor seating to patrons of their business.

A variety of tactical urbanism projects can serve as a basis for more widespread, permeant projects. Garnering initial public support is easier for tactical urbanism projects because they require little commitment. A defining attribute is the ability to show communities what a project will look like without having to commit to a permanent design or large expenses. In theory, a project that starts as temporary can evolve with regards to design, allowing its permanent version to be a better iteration of itself.

2.3 Transportation Resources Relating to Pandemic Responses

Several pandemic-related transportation resources have been published since the emergence of Covid-19 in early 2020. NACTO and GDCI published *Streets for Pandemic Response and Recovery*, which explains the necessity for people-focused streets during Covid-19 and characterizes how cities are reshaping their streets over a matter of days or weeks in response to physical distancing needs⁷. Similarly, a Canadian consulting firm focused on multi-modal transportation projects, Urban Systems, published “The Urban Project” *Covid-19 Street Rebalancing Guide* based on observations of emerging trends around the world gleaned through media and webinars⁸.

Both NACTO’s and The Urban Project’s documents generalize emerging practices with specific examples; they both emphasize that reorganization is contextual and locality specific. NACTO also has a general webpage providing resources for transportation responses: tools for rapid responses, including a transit and street response toolkit; on-the-

ground updates to serve as a compilation of city practices as a reference to transportation professionals; federal funding resources, including what federal support is available for providing essential services, such as transit; and external resources, such as webinars, podcasts, guides, and information centers relating to Covid-19 and transportation⁹.

In the initial phases of Covid-19, people used transit and cars less, and active transportation demand increased⁸, especially in cities where its usage is encouraged through new projects that feature dedicated space for physical distanced biking, walking, rolling, and playing. Streets started to be more readily considered as more than a place to just pass through, but as a destination itself, a place to be outside, walk, bike, exercise, and eat⁴. NACTO and The Urban Project assert that streets are tasked with balancing various needs, and these needs are expanded during a pandemic which requires social distancing⁷.⁸. Not only are streets used for travel, essential workers, and people to pick up essential items, but also as spaces for people to queue outside of grocery stores, markets, and essential businesses; a place for restaurants to expand their distanced seating capacity; as a respite for people without their own outdoor space; and for people to exercise⁷.

It is possible for streets to fulfill these various needs, but only when the current allocation of street space is reevaluated⁷ ⁸. The Urban Project lays out implementation strategies into four different themes: creating spaces to move, creating safe spaces to wait, connecting active transportation infrastructure implementation, and providing spaces for outdoor exercise⁸. **Figure 2** shows the various reorganization techniques that are being implemented during the Covid-19 crisis in order to better serve and protect our citizens. These prototypes share the common theme of providing more space for people to use the valuable public space that are streets.

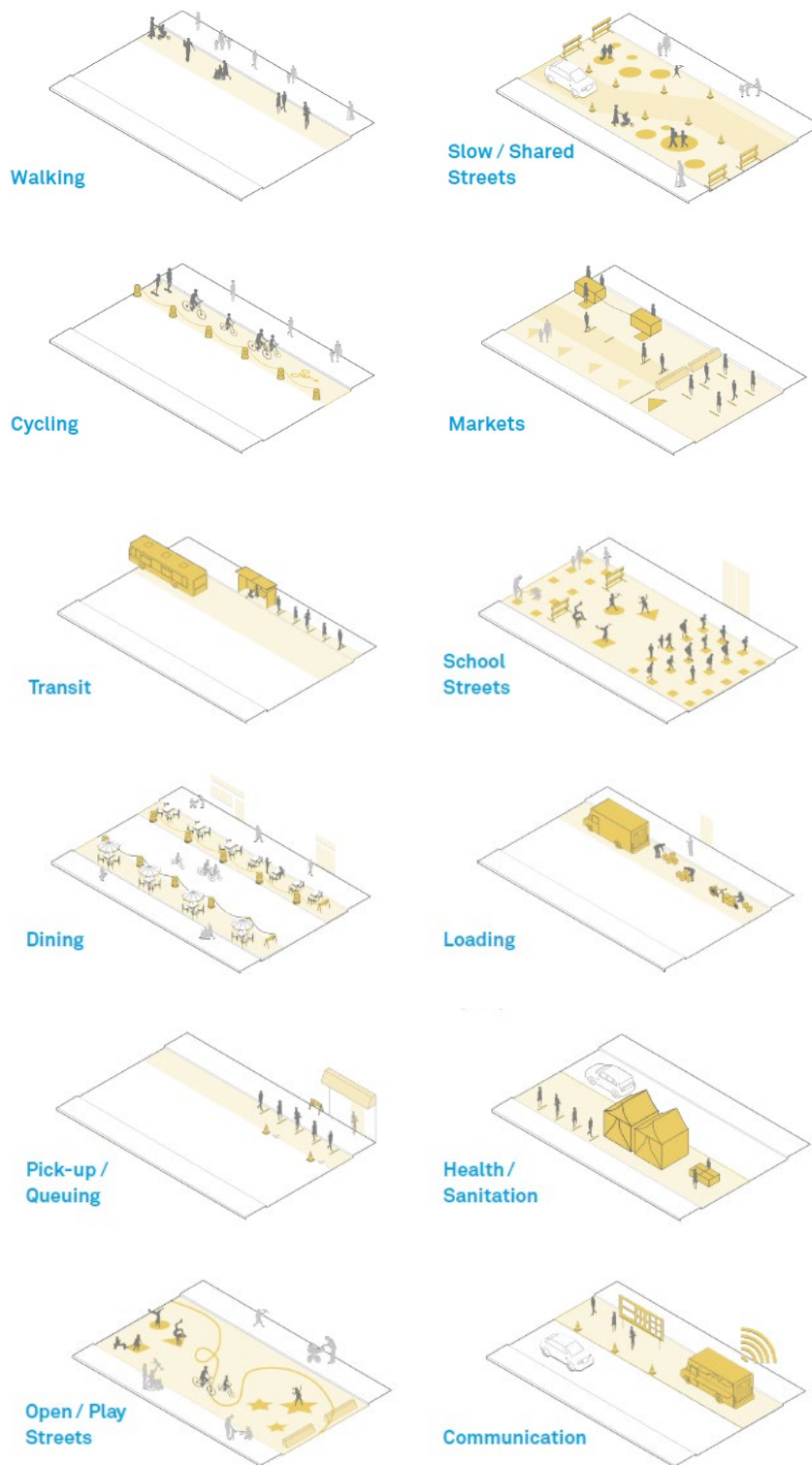


Figure 2. Rethinking streets during physical distancing. (NACTO Streets for Pandemic Response and Recovery, pg 6-7)

2.4 Equity Nuances of Open Street Policies during Covid-19

The consideration, acknowledgement, and transparency of who is reaping the benefits of repurposed streets during the Covid-19 crisis is crucial. Both NACTO and Urban Systems emphasize the importance of recognizing that Covid-19 is disproportionately impacting Black and brown people; thus, “inaction disproportionately impacts vulnerable communities more than others, particularly those living in urban centers⁸.” Furthermore, NACTO emphasizes that it is the job of city and transportation leaders to “not return to the inequitable, dangerous, unsustainable patterns of the past, but to help shape a better future⁷.” As the Covid-19 crisis coincides with the Black Lives Matter protests, the convenient ignorance of systemic inequalities is brought to the mainstream. Some organizations such as NACTO and Urban Systems as well as transportation professionals are doubling down on the stated and, hopefully acted-on, importance of not continuing the historical inequitable and unequal disinvestment in vulnerable populations⁷
8.

Some cities and urban professionals have further expanded this point. Using the pandemic as an “opportunity” to push “pre-pandemic agendas,” such as expanding bicycle infrastructure and opening more of the streets to pedestrians could ultimately foster more catastrophe than good¹⁰. Alissa Walker in a *Curbed* article argues that projects for Open and Slow Streets may primarily help the white advocates who have the ability to stay home and want space for recreation¹⁰. Walker calls for a more “nuanced discussion of what people who rely on those streets really need,” in addition to the recognition that creating more space to recreate is not a complete solution if some residents will be harassed by the police for using them¹⁰.

The Atlanta Bicycle Coalition (ABC) holds a similar viewpoint for their city which has made no street responses to Covid-19: although excited by the idea of a cultural shift towards active transportation, ABC has focused on potential equity concerns¹¹. ABC argues that its priorities have already aligned with Slow Street ideas and that it is crucial to focus on safety and accessibility in “underserved communities where people are more likely to walk and take transit”¹¹.

The *Untokening: Mobility Justice and Covid-19* guide is a mobility justice guide used by ABC in their Covid-19 decision process. This guide emphasizes that those who have the least freedom to stay home are those who are the most marginalized, many who are deemed “essential workers” during this pandemic. During this time, city agencies continue to focus and refocus on creating safe ways for these people to move around, not in creating space for those who have the freedom of staying home and need recreation space¹². Another concern shared by both ABC and the *Untokening* guide is that closing streets to cars could foster “unwelcome enforcement for Black and Brown people, who already face higher risk of negative police interaction”¹¹.

The increased demand for physical space affords cities “to quickly and effectively build out active transportation networks that address long-standing gaps, and support cities’ broader health, environmental, and equity priorities⁸.” Cities can and already have used the momentum created by the Covid-19 crisis to transition successful projects from temporary to permanent projects providing greater long-term connectiveness⁸. At the same time, it is important to consider for whom the projects are designed and what purposes they serve so as not to further marginalize the already marginalized.

2.4.1 Guiding Principles of Covid-19 Response and Recovery

NACTO lays out six recommended principles in informing cities' transportation responses to Covid-19. The principles focus on supporting the vulnerable first, as vulnerable populations are disproportionately impacted by Covid-19⁷, as well as complying with and facilitating public health guidance, such as maintaining physical distancing, and ensuring safety on our streets for the increased number of non-vehicular users. Further principles involve supporting local economies by providing space for businesses, schools, and institutions to safely reopen, while bringing communities into the rapid implementation process by providing channels for feedback. Furthermore, NACTO asserts that fast action with adaption over time is essential in order to inform lasting improvements and make the most positive impact possible during the Covid-19 pandemic⁷. The Urban Project has a similar focus on response strategies which address "equity and concentration of vulnerable communities, including racialized populations, people living with low income, and those who do not have access to a vehicle⁸." Additional considerations are addressing gaps in the active transportation network; accessibility for older populations and children; narrow sidewalks; proximity to parks, open space, and health care facilities; access to transit; and presence of essential businesses such as grocery stores⁸.

The essential functions of a street depend on what stage of experiencing the pandemic a community is in as well as the current function of the street. Both NACTO and The Urban Project look at transportation responses to Covid-19 through the lens of initial street function and current phase, ranging from immediate to long-term, of the pandemic a locality is in^{7 8}. For instance, the needs of neighborhood and residential streets

contrast with the needs and functions of major thoroughfares with offices and stores. Additionally, the nonpredictable phases of the pandemic elicit that cities employ different strategies non-linearly.

The Urban Project has broken down their street rebalancing guidance into three phases of the pandemic: rapid response, recovery, and resiliency⁸. NACTO has also separated their response into a similar three phases, but named differently: stay at home orders in place, pre-vaccine re-opening, and vaccine/ post-Covid⁷ (**Figure 3**). The first phase involves employing quick build materials used in tactical urbanism⁴ projects, such as signs, cones, and barricades, to transform streets into multi-use spaces, where people can access food, information, testing services, as well as exercise, all without people having to use transit or drive their cars^{7 8}.

As the pandemic is stabilized and long-term recovery is underway, but a vaccine is not yet developed, NACTO and The Urban Project highlight the importance of cities continuing to facilitate, through street project measures, public health recommendations of social distancing while moving around the city. Examples of these mid-phase responses include opening additional outdoor space for seating, such as parklets and patio spaces in order to support local businesses⁸. As a vaccine is developed, and cities finally move past Covid-19, cities can move forward in an evolved way, continuing to repurpose and reorganize streets in order to both prepare for similar future crises and to serve people in a more forward-thinking manner.

Outdoor areas are also be essential in providing schools, libraries, venues, and religious and cultural institutions the space necessary to provide the extra space needed for

people to stay safe while beginning to go back to school, work, or church⁷. When evaluating what kind of public health response to enact in the re-organization of streets, it is important that transportation planners and engineers carefully consider what stage of the pandemic their locality is in and the type of street in question, as demonstrated in the chart in **Figure 3**. For instance, if a locality is in the “pre-vaccine re-opening” phase, and the street is a “neighborhood main/high street,” then planners should be thinking about providing outdoor space for restaurant seating, outdoor markets, sidewalk expansions for queuing, and tactical bike lanes.

Public Health Response	Neighborhood Streets (local/residential)	Neighborhood Main/High Streets (small retail/office, residential, schools, institutions)	Major Urban Streets (transit, retail/ offices, institutions, schools)	Edge Streets & Boulevards (in/alongside parks, waterfronts, etc.)
Stay-at-home orders in place	<ul style="list-style-type: none"> • "open streets" (pop-up parks) • slow streets or local access only • speed management (movable barriers, gateway treatments, signs) • WiFi hotspots • open-air cooling zones/sanitation 	<ul style="list-style-type: none"> • sidewalk expansions for queuing, outdoor markets, & access • pop-up bike and roll lanes • temporary pick-up/ drop-off delivery zones 	<ul style="list-style-type: none"> • sidewalk expansions for access & queuing • temporary pick-up/ drop-off zones • shorten signal cycles • put pedestrian signals on recall 	<ul style="list-style-type: none"> • street closures to vehicular traffic, for medical services, recreation, markets, etc.
Pre-vaccine re-opening	<ul style="list-style-type: none"> • local-access only treatments • lane removal/street closures for schools & religious/cultural service providers 	<ul style="list-style-type: none"> • tactical lane/parking space removal, street closures for outdoor restaurant seating, outdoor markets, etc. • sidewalk expansions for queuing & access • tactical bike lanes • designated pick-up/ drop-off delivery zones • bike & shared micromobility parking corrals • lane removal/street closures for schools & religious/cultural service providers 	<ul style="list-style-type: none"> • bus-only lane, tactical islands/in-lane stops, bus priority signals, expanded bus stops • lane removal/parking space removal for outdoor restaurant seating, outdoor markets • sidewalk expansions for queuing & access • protected bike lanes • speed management 	<ul style="list-style-type: none"> • street closures to vehicular traffic, e.g. for recreation, markets, schools, etc. • expanded bike lanes & bike/shared micromobility parking zones • speed management
Vaccine/post-COVID	<ul style="list-style-type: none"> • speed management (e.g. speed limit changes & geometry) • play streets, slow streets, and local-access-only policies & design 	<ul style="list-style-type: none"> • sidewalk widenings • speed management (e.g. speed limit changes & geometry) • expanded bike lanes & bike/shared micromobility parking zones 	<ul style="list-style-type: none"> • bus-only lanes with offboard fare collection, bus islands, and amenities • high frequency bus service • expanded bike lanes & bike/shared micromobility parking zones • sidewalk widenings • speed management 	<ul style="list-style-type: none"> • open space expansions • expanded bike lanes & bike/shared micromobility parking zones • speed management

Figure 3. Types of policies to consider, based on stage of pandemic and the type of street. (NACTO Streets for Pandemic Response and Recovery)

Cities can use the authority of most roadway-owning agencies in order to enact rapid response infrastructure which aligns with public health guidance on physical

distancing and provide accessibility for people in cities across the world⁷. NACTO states that, “there is often enough room for physical distancing on streets, but much of this space is currently assigned to motor vehicles by default⁷.” Cities can find space for physical distancing and safe mobility through the following space reassignments⁷: remove individual parking spaces or a curbside parking lane, narrow a motor vehicle lane(s), shift parking or loading away from the curb, even if this closes a vehicle lane, designating a street as local access only to reduce vehicle volumes and speeds, and by closing a vehicle lane or an entire street to allow for adequate physical distancing and to improve accessibility for all road users⁷.

NACTO lays out some guidelines for implementation, recommending that lighter materials be used for temporary, short-term implementation, while durable materials be used for more permanent deployment. Some temporary projects may shift to permanent, and as this happens, materials should be accordingly replaced and adjusted⁹. NACTO recommends that barriers and signs be placed along a street where drivers and riders need to do something new. Signs can be made of various materials, and state, local, and national standards should be consulted for official colors, signs and symbols. This kind of guidance may be more suited for motor vehicle traffic control, rather than for pedestrian and bicycle needs⁷. Lighter materials used for separation between vehicles and pedestrians/bicycles includes traffic cones, free-standing delineator posts, traffic barrels, sawhorses, movable parade barricades, and small planters. Heavy separation for more “sensitive locations” such as the beginning of a lane closure on a high-volume street includes water-filled barriers, concrete barriers, filled barrels, large planters, and flexible posts and delineators.

2.5 Types of Transportation Responses to Covid-19

A variety of street re-organization responses may be appropriate depending on the type of street, the surrounding area, the current design of the street, and the purpose for re-organization. A typical path forward for planners and engineers is to plan a response, engage with the community, design and implement a response, and monitor the response so that cities can keep track of usage^{7 8}. Engagement with impacted stakeholders and the broader public may be limited because of the quick build nature of pandemic responses; however, this same quick-build, temporary nature of the materials which limits engagement time also allows communities to see firsthand what a project is like and then provide feedback as projects sometimes develop into more permanent projects⁸. Monitoring the response helps to facilitate the potential transition from temporary to permanent installations. Both NACTO and The Urban Project detail some typical responses from cities. These responses are summarized **Figure 2** above. The following synthesizes information from both sources to give detailed descriptions on the most common types of responses.

Bike and roll lanes “provide space for essential workers and others to bike and roll safely while maintaining sufficient physical distance from others⁷.” Bike lanes are appropriate on multilane streets, streets with wide lanes where demand is high, and streets that provide access to essential services, such as to hospitals or parks and open spaces⁷. NACTO recommends prioritizing filling gaps in existing bike networks, transit routes, bike routes awaiting implementation, and streets that already have ridership. To monitor the bike/roll lane, automated devices such as a tube counter can be installed to collect counts. The yellow color in **Figure 4**’s diagram shows the additional space given to people not in

cars, and **Figure 5** shows how cones were used in Minneapolis to give extra space to those not in vehicles.

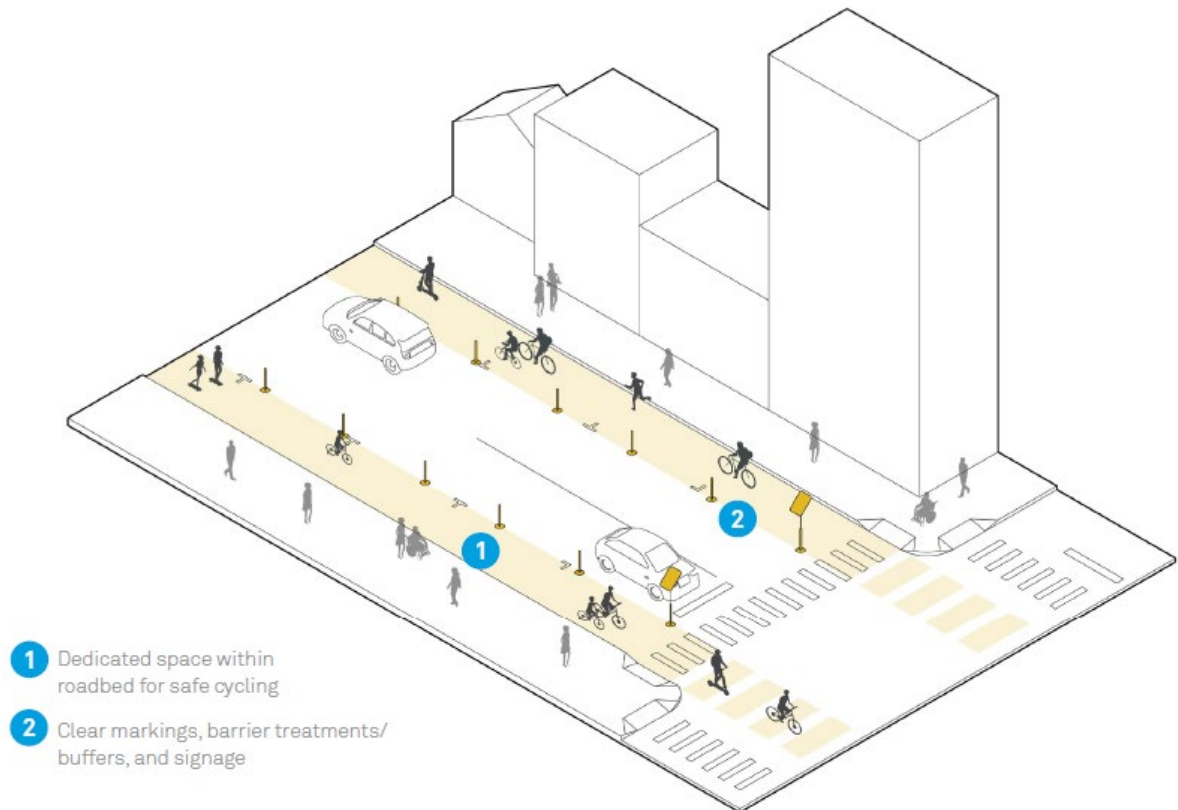


Figure 4. Bike/ roll lanes. (NACTO Streets for Pandemic Response and Recovery)



Credit: Minneapolis DPW

Figure 5. Minneapolis added 11 miles of bike lanes in order to allow a safe space for biking and rolling while maintaining physical distancing. (NACTO Streets for Pandemic Response and Recovery)

Sidewalk extensions⁷ or **temporary pedestrian lanes**⁸ “provide space for people to comply with physical distancing guidelines while walking or waiting⁷. Extending sidewalks is most needed along main streets and major thoroughfares with essential businesses/services, high transit use, or crowded recreational paths⁷. Curbside parking or a motor vehicle lane extension are appropriate places to extend sidewalks. The lane can be protected with reflective barriers such as freestanding delineators or traffic barrels. To ensure accessibility, temporary curb ramps installed mid-block should be considered⁸. **Figure 6** shows how sidewalks can be extended into the streets to give more space to socially distant walk. **Figure 7** shows examples of extended sidewalks for those walking and biking in Milan and Brookline.

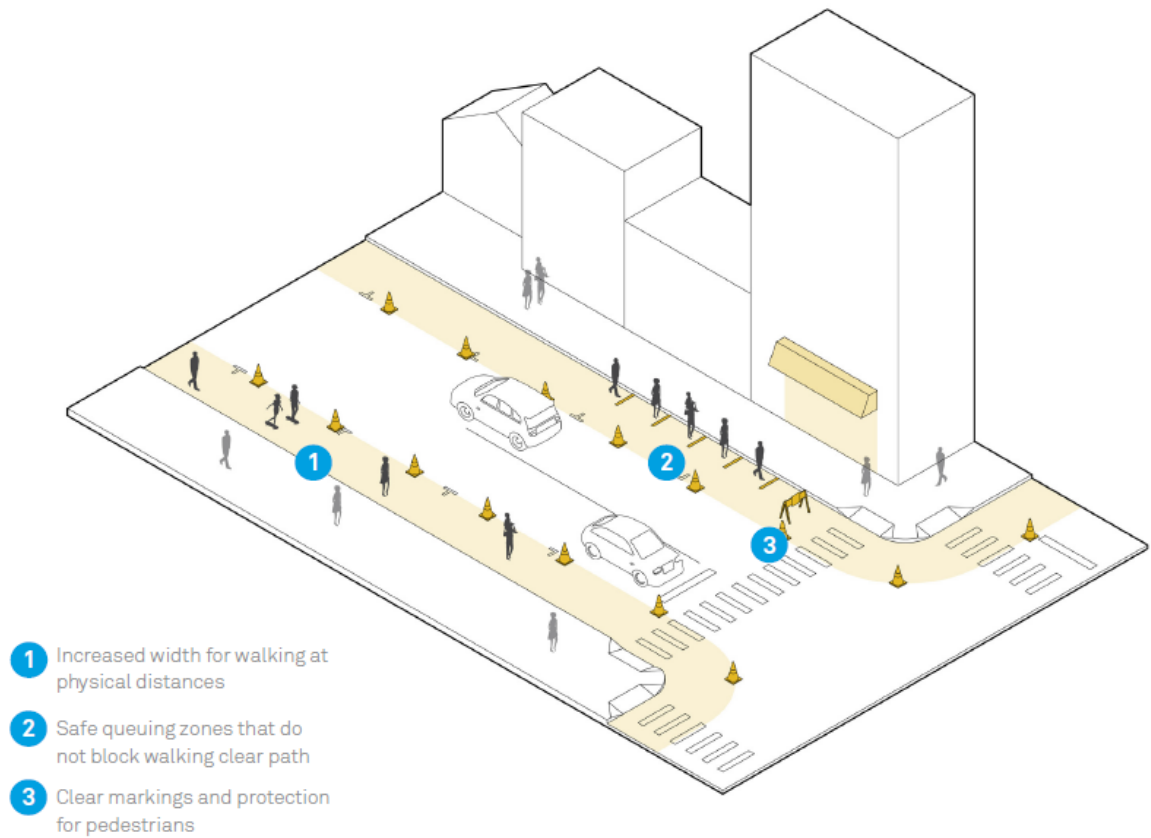


Figure 6. Sidewalk extension. (NACTO Streets for Pandemic Response and Recovery)



Credit: AMAT Officina Urbana/Comune di Milano

Milan, Italy

Milan created a citywide plan to implement new pedestrian and bike facilities on 35 km of streets. On this 4.5-km corridor over its busiest subway line, the City used paint and markings to widen sidewalks and add a parking-protected bike lane.



Credit: @BLineTransport

Brookline, MA, USA

Brookline used cones and temporary signs mounted on freestanding delineator posts to extend sidewalks and create bike lanes along four high-volume streets.

Figure 7. Examples of sidewalk extensions in Milan and Brookline. (NACTO Streets for Pandemic Response and Recovery)

Transit lanes “provide or expand transit-only/ transit-priority lanes to ensure that surface-level transit can continue to be a reliable and efficient form of transportation for the people who need it most⁷.” NACTO states that transit-lanes are most appropriate on high-ridership transit corridors and routes that serve transit-dependent communities. To add transit lanes, cities can convert curbside parking or motor vehicle lanes and designate the transit-lanes with paint and striping, signage, or barriers⁹. **Figure 8** shows transit only lanes.

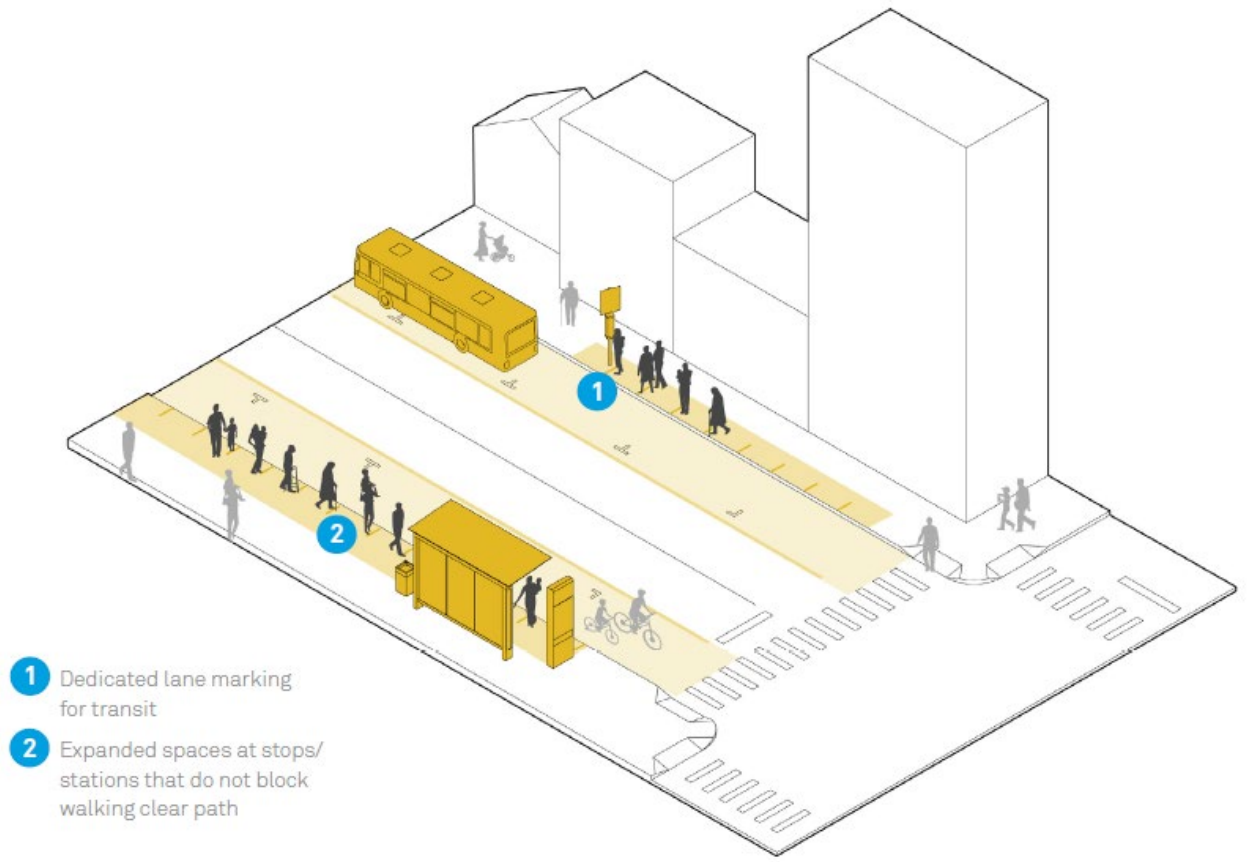


Figure 8. Transit lane. (NACTO Streets for Pandemic Response and Recovery)

Slow streets⁷ or **shared streets**⁸ “reduce traffic volume and speed to a minimum so that people can walk, bike, and run safely. Slow streets are appropriate on streets with low vehicle volume and low to moderate speeds or streets that serve redundant through-traffic roles. Volumes may already have been low, or they may have lowered due to decreased travel during Covid-19. To implement slow streets, NACTO recommends temporary traffic barriers and branded signs at main vehicle entry points and to allow local access, deliveries, and emergency vehicles. Those that live in the neighborhoods can be stewards to monitor the barricades in case they are moved or knocked over. Shared streets are sometimes implemented only during designated times but doing so is more labor

intensive with regards to setting up and taking down barricades. **Figure 9** shows a slow street with mixed traffic and pedestrians.

Similar to slow streets are **full street closures**, where the full street is closed to motor vehicle traffic in order to reallocate the space to active forms of transportation⁸. There is limited access for emergency and maintenance vehicles. Full street closures are most appropriate on major streets with limited intersections and access requirements. Commonly used materials include light or heavy barricades and temporary chicanes along with road closure signs. In Oakland, simple signs were used in order to indicate that roads were closed to through-traffic, as demonstrated in **Figure 10**.

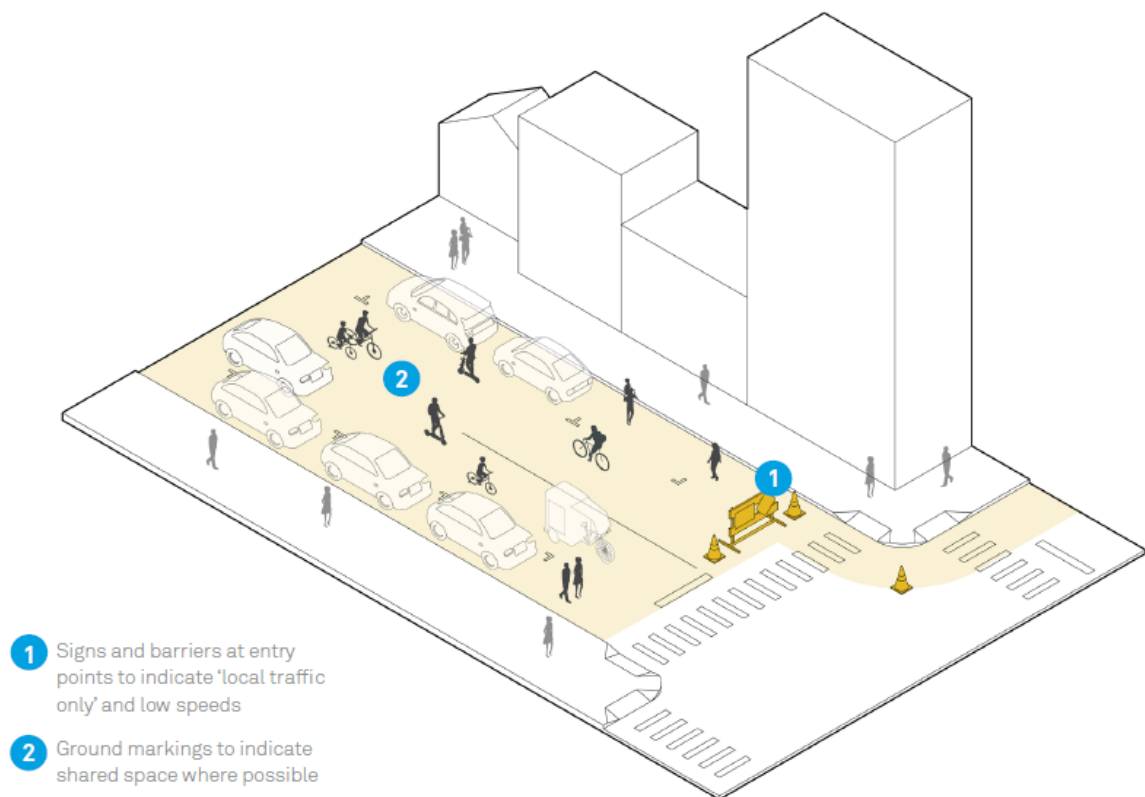


Figure 9. Slow or shared streets. (NACTO Streets for Pandemic Response and Recovery)



Credit: @jonobate

Oakland, CA, USA

Oakland used signs mounted on A-frames to designate streets as local access only, creating a 74-mile “slow streets” network.

Figure 10. Shared street example in Oakland, CA. (NACTO Streets for Pandemic Response and Recovery)

Providing **pickup and delivery zones**⁷ or **priority loading areas**⁸ entails converting “curbside parking spaces or travel lanes to high-turnover pick-up or delivery zones serving essential businesses⁷.” These zones are most relevant at restaurants, pharmacies, and other essential services. Cities can use spray chalk, paint, stickers, or traffic tape to delineate pick-up space. Time limits, such as maximum of 10 minutes, should be put in place. In the diagram in **Figure 11**, typical parallel parking is transformed to pickup and delivery zones.

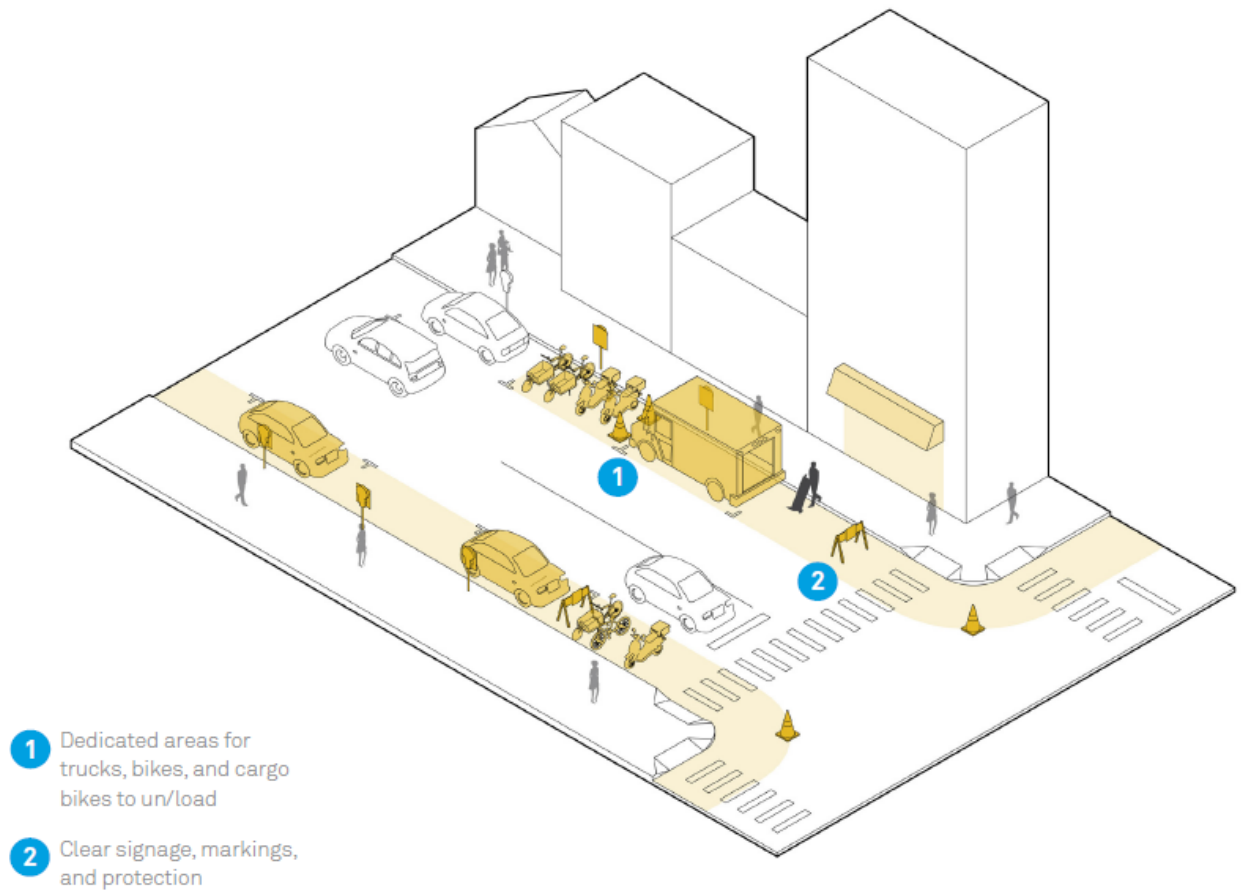


Figure 11. Pickup and delivery zones. (NACTO Streets for Pandemic Response and Recovery)

Providing space for **outdoor dining** gives space to restaurants so that they can “comply with physical distancing guidelines while resuming dine-in operations⁷.” This kind of treatment is most appropriate where restaurants and cafes are clustered together along several blocks. Cities can waive permit fees for outdoor dining and can also establish clear occupancy standards. **Figure 12** shows how parking lanes or extraneous travel lanes can be utilized for outdoor dining. In Tampa, FL, a whole street was closed in order to accommodate outdoor dining, as shown in **Figure 13**.

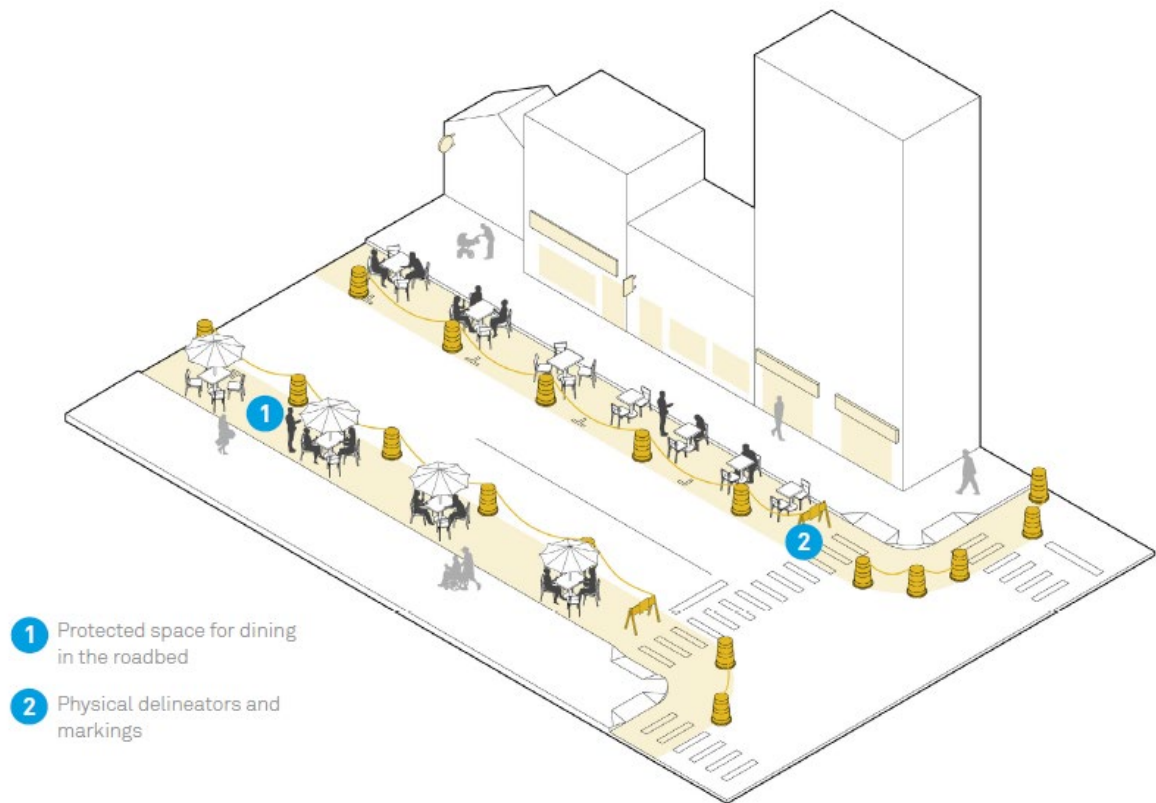


Figure 12. Outdoor dining. (NACTO Streets for Pandemic Response and Recovery)



Credit: Tampa Downtown Partnership

Tampa, FL, USA

Tampa has temporarily suspended approval requirements for restaurants to expand operating space in designated portions of the public right-of-way.

Figure 13. Example of outdoor dining expanded to the streets in Tampa, FL. (NACTO Streets for Pandemic Response and Recovery)

Markets can be given expanded space to ensure physical distancing is possible while still encouraging and allowing open air markets to flourish. Giving expanded street space to markets is appropriate on streets with permanent or active open-air markets, streets adjacent to market buildings or public spaces with markets. Planners can work with markets to help them define safe layouts, spacing, and circulation routes based on local physical distancing guidelines. **Figure 14** and **Figure 15** show expanded outdoor markets in order to accommodate social distancing guidelines.

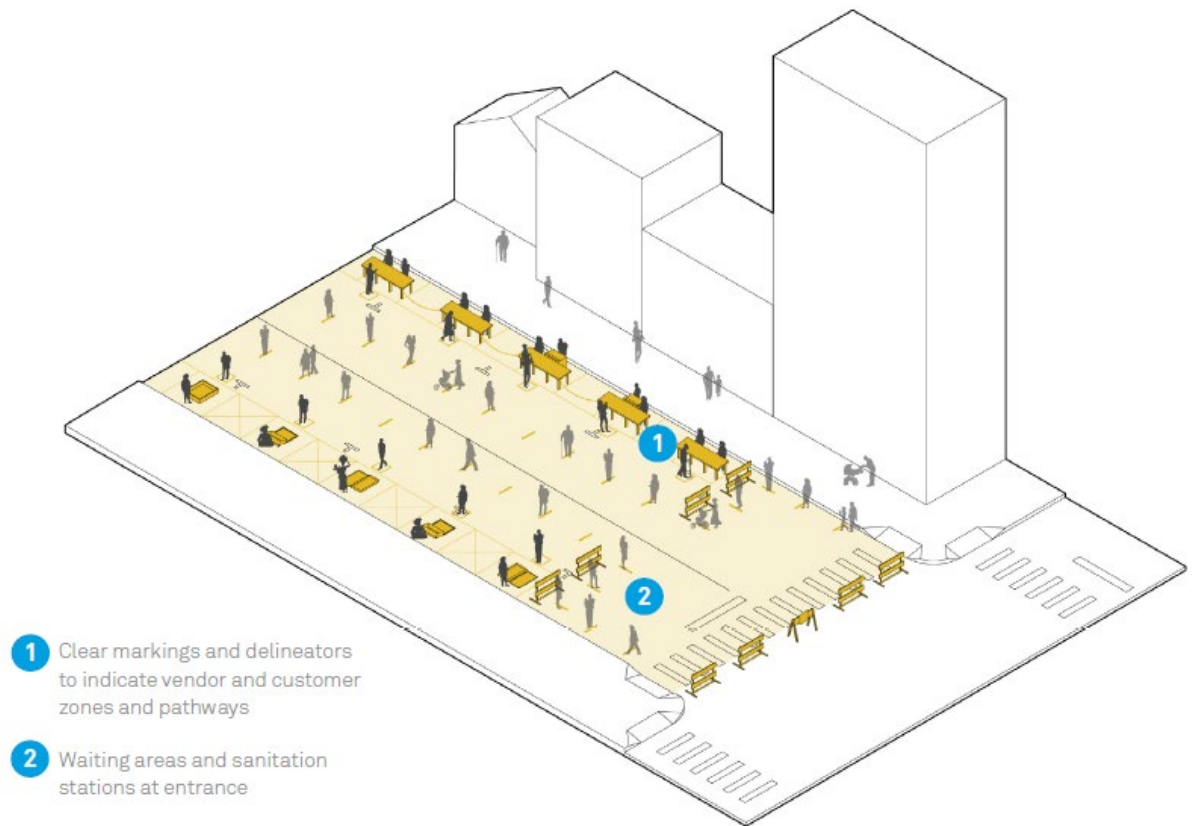


Figure 14. Outdoor markets with expanded space. (NACTO Streets for Pandemic Response and Recovery)



Credit: Jain Weraphong

Kalaw, Myanmar

In Kalaw, paint was used to mark vendor stall locations in the marketplace, separating vendors and allowing customers to shop safely.

Figure 15. Example of expanded outdoor market in Kalaw, Myanmar. (NACTO Streets for Pandemic Response and Recovery)

Pedestrian pushbutton automation involves converting “pedestrian actuated signals to automated signal timing” so that pedestrians no longer have to “beg” to cross the street⁸. Doing so diminishes the amount of physical contact people have to make with public spaces. Many places are doing away with pedestrian beg buttons permanently, the theory being that pedestrians should not have to ask to cross the street. **Figure 16** shows a pedestrian push button that has been automated during Covid-19 in Providence, RI.



Figure 16. Pedestrian signal button automated in Providence, RI. (City of Providence)

From outdoor dining to expanded sidewalks to open streets, there are a variety of street and transportation projects which can help facilitate outdoor space where people are able to properly social distance while still enjoying the outdoors. As people are confined to their apartments and homes which are sometimes small and often lack yards, especially in dense cities, the streets become a place for people to escape to, and it is the duty of cities to ensure that people can enjoy these outdoor spaces in as stress-free and safe a manner as possible.

2.5.1 Overview of Specific Covid-19 Transportation Responses

Transportation responses to Covid-19 vary from city-to-city, street-to-street, temporary-to-permanent, and time of day. According to a document of city responses from all over the world, the five most common in order of percent of response, are as follows:

open streets (37.5%), open curbs (15.5%), slow streets (16.1%), temporary bikeways (18.6%), and pedestrian signal recall (12%)¹³. Globally, the city with the most proposed or existing mileage of street responses is Paris, France with 403.8 miles, as of August 20, 2020. There are 4 U.S. cities in the top 20 list, in descending mileage order: New York City, Portland, Oakland, and San Francisco.

Some open street projects involve a full closure of streets to cars in order to make more room for social distancing. Street closures can involve opening residential or commercial streets, parkways or waterfronts, or main city streets to people. In the most extreme case, the city of Kampala in Uganda banned all road traffic in an attempt to prevent the spread of Covid-19¹⁴. Other open street projects are intended to create space for outdoor dining, sometimes dubbed “Streateries.” For instance, Indianapolis, Indiana plans to enact “Dine Out Indy,” where segments of 5 major streets will close, eliminating 499 parking spaces in order to make space for people to dine outside¹⁴. In some instances, residents have used spray-paint, sawhorses, barricades, and cans of food in order to create “unsanctioned open streets” for people¹⁴.

Open curb projects can involve travel or parking lane conversions with differing intentions: adding bus lanes or bikeways, expanding sidewalks/ pedestrian space, expanding space specifically in front of grocery stores for queueing. Slow street projects limit vehicular access by allowing only local traffic and reducing the speed limit. These “shared streets” are often residential and neighborhood streets, where traffic can be diverted and restricted to local only access. Temporary bikeways include the conversion of a travel lane to a two-way bikeway, converting curbside lanes to bikeways, and adding bikeways to street segments. While some cities, such as San Francisco, have long forgone

pedestrian beg buttons, other cities have eliminated pedestrian beg buttons during Covid-19, often permanently, so that people do not have to press a button to “ask” to cross the street: now it is assumed that pedestrians need a cycle. Not only does this eliminate people unnecessarily touching surfaces during the current pandemic, but it also sends a message to pedestrians and people in vehicles that pedestrians also occupy a space along the road and in intersections.

2.6 Summary of Literature Review

For centuries, pandemics have shaped cities, often positively³. As airborne pandemics are likely to again affect cities, it is important for cities to continue to use the momentum created during the current Covid-19 pandemic to provide residents the space and infrastructure necessary to travel, recreate, and conduct essential services during an airborne pandemic. During the current pandemic, city transportation practitioners have utilized tactical urbanism and quick-build projects in order to support their residents during a time when the CDC recommends 6-feet of distance between people. The types of tactical urbanism projects most commonly used during Covid-19 are slow and shared streets, outdoor dining and markets, pick-up spaces (mostly for food pick-up), and transit-only lanes. At the same time that city transportation practitioners are accelerating and enacting tactical urbanism projects, it is important that they consider their city’s vulnerable populations; this includes paying attention to where the projects are as well as who is enforcing the streets, if anyone. The current pandemic especially affects those who depend on transit to commute to essential services, so these populations should especially be supported during this time through tactical urbanism projects focusing on essential travel.

CHAPTER 3. RESEARCH METHODOLOGY

3.1 Objectives

Airborne pandemics are likely to again affect cities. The widespread nature of Covid-19 has demonstrated that cities need plans in place for their residents to live during a pandemic which can last many months or years. Lockdowns and full quarantines can be ephemerally effective but are proving unrealistic long-term. In order to protect their residents, cities have reacted in different ways with different processes responding to Covid-19. Providing safe outdoor spaces to travel and recreate is a vital part of public health recommendations during the current airborne pandemic; therefore, many cities, and especially dense cities, have altered the public right-of-way for people to safely recreate, dine, and exist outside.

This project seeks to characterize transportation responses to Covid-19 and how these responses can relate to future pandemics, as well as how they are changing and will change the nature of our cities now. Characterizing the causes, processes, and consequences for fast-tracking more open, usable, community-oriented streets in response to Covid-19 will help planners, engineers, and city officials understand limits and strengths of responses. Practitioners can see how these responses might relate to creating a just and equitable transportation system, as well create a precedent to provide safe places for people during the current and potential future airborne pandemics.

This project seeks to answer whether the current Covid-19 crisis has been used in transportation planning to advance cities in a way that is more street-friendly and

community-oriented. An additional aim is to answer what aspects of a city might have contributed to a city's greater propensity to initiate Covid-19 street-friendly projects and what unique challenges and successes cities, businesses, and residents have faced regarding street-focused projects during the Covid-19 crisis.

In addition to the more design and policy-related questions about transportation responses to Covid-19, another goal is to learn about whether marginalized populations and business-owners who are disproportionately affected by Covid-19 are being supported by these responses and the nuances associated with open-street type policies.

3.2 Methodology

The author has utilized relevant Covid-19 articles and resources published from the start of Covid-19 until November 2020. Four cities were chosen as "case study" cities in order to take a deeper look at different aspects of Covid-19 street-focused projects. The four case study cities were chosen because they all had Covid-19 related city-wide street-focused projects and because city agency employees responded to the author. Cities that were considered for case studies all enacted multiple kinds of transportation responses to Covid-19. Eight cities were contacted, and of these, four moved forward to serve as case studies. The cities are San Francisco, Portland, Seattle, and Toronto.

In addition to the case study interviews and write-ups, the author has created geographic visualizations for each of the four case study cities using ArcGIS. The purpose of these maps is to visualize where open street projects have been enacted and to compare them to city-defined vulnerable neighborhoods and populations. The maps show each city's respective locations of Covid-19 street-focused projects, existing bicycle network,

street network, and city-agency defined vulnerable neighborhoods or populations. These maps are intended to visualize where exactly Covid-19 street-focused responses are and how they are dispersed relative to a city’s affluent and vulnerable neighborhoods. Percentages of the amount of Covid-19 street response that falls within a 0.25-mile buffer of a vulnerable neighborhood are highlighted on the maps. Then, percentages are calculated for what proportion of a city’s total Covid-19 street response occurs in vulnerable neighborhoods by land area.

3.2.1 Case Study Interview Questions

For each of the interviews conducted, some of the same general questions were asked; these are listed in **Table 1** below. During an interview, the author may have asked further questions in response to answers received, or an interviewee may have given more information on certain topics that were not explicitly asked about. These nuances are reflected in the case study write-ups themselves.

In **Table 1**, “open-street type policies” refer to all the iterations of “open-streets” during Covid-19, such as outdoor dining (“streateries”), slow streets, shared streets, temporary bike/roll lanes, curb extensions, etc.

Table 1. List of general interview questions asked to all case study cities.

- | |
|---|
| <ul style="list-style-type: none"> • How interested has your city been in open-street type policies prior to Covid-19? • What were the initial factors instigating the type of projects that have been fast-tracked or initiated during Covid-19? • In what ways did certain pressures generate the kinds of projects selected? • How was the process different to get these projects approved during the pandemic than during “normal” times? Will this potentially contribute to how projects are approved in the future? |
|---|

- Considering that cities' resources are under significant financial and general stress, how did these projects still manage to happen? Were they done more cheaply, and if so, what aspects of the project were able to have costs cut?
- What, if any, pushback has there been? What has been praised?
- How are marginalized communities and those disproportionately affected by Covid-19 being supported through open street/ healthy businesses projects?
- How will the changing weather / length of pandemic affect policies put into place during Covid-19?
- In your opinion, will the projects enacted under Covid-19 change the course of how the city progresses? If so, in what ways?

CHAPTER 4. TRANSPORTATION RESPONSES TO COVID-19:

A CHARACTERIZATION AND FUTURE IMPLICATIONS

This chapter details the results of case study research and interviews conducted in order to characterize open-street type responses to Covid-19. Four case studies are presented with the GIS visualizations at the end of each separate case study.

4.1 Organization of Results

The results include qualitative write-ups for the case study cities. Each of the four case study sections begin with a general overview of the city's street-related response to Covid-19. Following is a synthesis of information from interviews supplemented by online resources. This section begins with factors contributing to a city initiating street-related responses to Covid-19, continues with logistics associated with the projects, followed by feedback and the future of projects. Concluding each case study is the equity section, which discusses how a city is addressing the fact that vulnerable communities have been disproportionately impacted by Covid-19⁷. Included in this section is a GIS map for each city showing where transportation responses are relative to Equity Areas. This section also includes a table comparing different proportions related to Covid-19 transportation responses and Equity Areas.

4.2 Case study: San Francisco

4.2.1 Transportation Response Overview

San Francisco's Municipal Transportation Agency (SFMTA) has implemented several initiatives in order to support its residents during the Covid-19 crisis. San Francisco's "Slow Streets" program is intended to restrict through-traffic on certain residential streets and to reduce speed limit to allow these streets to be used as socially distant shared spaces for travel and exercise¹⁵. As of November 2020, twenty corridors, or 44 miles, have been planned and implemented as Slow Streets. **Figure 17** shows a Slow Street being utilized on Halloween. Signs have been added to help minimize vehicles and to prioritize walking/ biking. Simple tools such as temporary signs and cones are used to divert through-traffic and slow down overall speeds.



Figure 17. Slow Street on Halloween. (@jeffreytumlin)

SFMTA is also implementing temporary emergency transit-only lanes in order to serve San Franciscans who rely on Muni to get to work and essential places; as traffic congestion returns, this is essential for those who are transit-dependent¹⁶. The transit lanes are easily reversible, as they are striped with white paint and stenciled with “Bus/Taxi Only.” The lanes are automatically removed within 120 days after the public health emergency order is lifted, unless the Agency goes through the typical public process to make a lane permanent¹⁶.

Additionally, the “Shared Spaces” program is a multi-agency program of San Francisco’s Economic Recovery Task Force, of which SFMTA is one of the agencies. Shared Spaces provide businesses and community groups with free permits to make it easier to use outdoor space for restaurant pickup and other neighborhood retail activities¹⁷. As of October 2020, 1,300 permits have been approved for various Shared Spaces. Shared Space permits include using the sidewalk or parking lane, the street, private property, Port space, and park space for business. **Figure 18** shows a Shared Space for dining in street in San Francisco’s Sunset district. SFMTA has an interactive map where the Shared Space issued permits are mapped. On the map, dots indicate where all the approved Shared Spaces are located. The dots can be clicked on, and information such as the permitted business, the address, and the use of the permit shows up. As of October 20, 2020, there are 364 parking lane, 484 sidewalk and parking lane dining, 389 sidewalk dining only, and 345 parking lane dining and retail only permits¹⁷.



Figure 18. Shared space for dining in the Sunset district. (@jeffreytumlin¹⁸)

4.2.2 Initiating Factors in Covid-19 Transportation Response¹

Prior to Covid-19, San Francisco was a city that already had a predisposition to people-oriented transportation decisions. Not only does the city operate with a “Transit First” policy, but it also participates in Vision Zero. In addition, SFMTA had been working on what they call, “Neighborweighs.” For Neighborweighs, SFMTA takes low stress streets and designates them as a part of the bike network even if they do not have bicycle

¹An interview was conducted with the Slow Streets program director. Much of the information in this and the following sections (4.2.2-4.2.5) is a synthesis of the interview and online research, mostly utilizing SFMTA’s website.

facilities¹⁹. When a city transportation agency takes the time to specifically signal and build out a bike network, it demonstrates to constituents that the city deems cyclists as a real and viable part of the whole transportation network.

The city of San Francisco followed Oakland's lead in creating specific Covid-19 transportation corridors. An additional instigating factor was the drastic reduction of Muni: SF had eliminated or reduced half of Muni routes, making there fewer choices for people to move around the city¹⁹. To exacerbate this issue is the six feet social distancing recommendation. People waiting outside of grocery stores in long lines crowded the sidewalks, forcing people walking to go into the street to maintain the public health guidelines of six feet distance from others. The two main factors that instigated San Francisco to start taking action during Covid-19 were watching their neighboring city, Oakland, initiate Covid-19 transportation responses, as well as watching residents of their dense city need more space¹⁹.

4.2.3 Logistics of Projects

Very little initial formal process went into the Slow Streets program, as the city was figuring it out as they went along, and everything happened quickly. SFMTA announced the program on April 21, 2020, with 12 corridors. The plan was to build these 12 corridors and be done with the program. The program was announced on a Tuesday, and the 12 corridors were built by Friday. The public quickly supported and showed interest in bringing these types of streets to more neighborhoods, so one day after the program's launch, SFMTA started on Phase 2, where SFMTA built 5 more corridors starting on May

16. Phase 3 of the program was initiated on July 21, which was supposed to be the last phase of the program¹⁹, but as of October 2020, a Phase 4 is now in progress.

Phases 1 and 2 were more easily approved through an emergency authorization and because of the necessity for quick action. Phase 3 faced four California Environmental Quality Act (CEQA) appeals, which were heard by the San Francisco Board of Supervisors in October 2020. The Board ruled unanimously in support of the projects, so Phase 3 projects were able to move forward after being stalled awaiting the Board ruling²⁰. For Phase Four, the City is seemingly evolving in their selection process for Slow Streets and is intentionally seeking out the “big parts of the city that [they] just didn’t hear from¹⁵” in their online questionnaire and email account. San Francisco has identified several neighborhood groups they will work with to develop where Slow Streets could work for Phase Four.

Outreach for the program has mainly been through electronic engagement, and SFMTA created a Slow Streets email and webpage, as well as a six-question survey that has been the biggest source of where the city has gotten suggestions for slow streets. The survey has had 6,0000 responses and hundreds of recommendations for where to put Slow Street corridors¹⁹. To reach residents, SFMTA put up flyers, dropped off notices at takeout restaurants and grocery stores, and sent flyers to all residents along blocks adjacent to specific Slow Street corridors. SFMTA has conducted virtual community meetings, which many have attended. Having said this, SFMTA has recognized that they have not heard from parts of the city and are intentionally seeking out these areas for Phase 4.

In terms of legislating the streets, the program has zero enforcement. Generally, self-enforcement of the streets works well¹⁹. Barricades are put up, and people and cyclists start congregating in the roadway more and more. **Figure 19** demonstrates signs used to restrict streets to through-traffic.



Figure 19. Slow Street on Noe Street, designated by Road Closed sign.
(@jeffreytumlin²¹)

One of the biggest challenges for San Francisco has been getting enough resources for the projects. Since the implementation of Slow Streets, the Type 3 barricades and signs, which are used for Slow Streets, cannot be ordered quickly enough¹⁹. To exacerbate the issue, the city originally thought the barriers and signs would be up for 2-3 weeks, yet they have now been up for over 5 months. Eventually the city intends to move from the barricades to delineators. Since Phase 3 was stalled due to CEQA appeals, SFMTA used the time to repair the existing Slow Streets network and to fill in signage gaps²⁰. SFMTA

has also taken the time to reiterate on their website that Slow Streets are for “essential trips, not neighborhood gathering points²⁰.” When blocks of streets are closed to much of traffic, people have tended to gather in the streets, instead of moving through them, as is intended by the Agency.

4.2.4 Feedback to and Future of Responses

The projects implemented during Covid-19 have had mass appeal: the Slow Streets program director presumes some of this appeal has to do with people being trapped in their homes and needing the ability to get outside safely. In a survey, 78% of people are in support the Slow Streets²², and many of the comments centered around peoples’ realization that they never considered how much space was given to cars nor realized the freedom that comes along with biking in the roadway¹⁹.

SFMTA’s guidelines for choosing Slow Streets are extremely restrictive; the Agency points to this as a reason why the program is so successful. SFMTA has screened hundreds of corridors. Corridors that are screened out have these attributes: conflict with Muni; are emergency routes or loading zones; have only 1 lane of traffic in each direction; or have obstructions to driver’s sight. Corridors considered should not be signalized and should be flat, usually are residential streets. In fact, SFMTA put in a corridor on Stockton Street in North Beach area that they took out after a short amount of time because the corridor was on a big hill, and people unsurprisingly feel uncomfortable hanging out on a huge incline when they are on wheels, whether it be bike, scooter, or skates.

For the Slow Streets corridors that are doing well, SFMTA has loosely considered some permanent closures of the streets. To do so, the city would have to go through the

official Quick-build Project process where a project is submitted to the SFMTA board with a robust outreach process¹⁹. Although deemed “quick-build,” this process is multi-year. Each closure would be its own project, and SFMTA would want to consider how certain corridors fit into the larger bicycle and walking network. To choose which projects to put through the Quick-build Project, SFMTA would consider how these Slow Streets link up to the current bike network that allows people to travel around the city in low stress routes. The city would want the projects stemming from Slow Streets to be a real part of the city’s infrastructure network.

4.2.5 Equity

The Slow Streets program manager acknowledged that the first two phases of Slow Streets happened quickly and with little public input. Input was requested for these phases, and SFMTA is focusing on “historically under-served neighborhoods to conduct outreach²³.” From November 10 to December 10, 2020, Phase 4 outreach will center around the neighborhoods which do not have Slow Streets to see if there is support or interest. For the targeted neighborhoods, the agency has already chosen several Slow Street candidates in each neighborhood. They hope to broaden their outreach through a multi-faceted outreach process, involving online questionnaires, socially distant in-person outreach with residents, community meetings, and online office hours²³. Phase 4 is expected to be implemented early 2021.

The agency has also specifically focused on the Tenderloin, which is a neighborhood that has been disproportionately affected by Covid-19 because of “pre-existing circumstances that Covid-19 has viciously exacerbated, including an increase in

unsheltered homelessness, heightened congregating in permanent supporting housing, and a reduction of quality of life and safety for housed and unhoused residents, alike²⁴.” The Tenderloin is a diverse, dense neighborhood with local, historic businesses. The City conducted a large block-by-block Neighborhood Safety Assessment and came up with a Neighborhood Plan outlining specific recommendations for the whole neighborhood with specific focuses on the 13 most impacted blocks²⁴. Responses include providing safe sleeping alternatives to encampments, closing streets and limiting parking to aid social distancing, improving access to hygiene stations, and more²⁴. Because of the street typology of the Tenderloin, SFMTA has not placed any Slow Streets in the Tenderloin, as the neighborhood does not have the low-vehicular, residential traffic characteristic of candidates for Slow Streets²⁵. Thus, the Neighborhood Plan is a way for the City to address Covid-19 health concerns in this highly impacted neighborhood.

Locations of Slow Streets, Phases 1-3, were mapped in **Figure 20** alongside of vulnerable areas, as designated by the City. The Invest In Neighborhoods (IIN) Areas²⁶ is an initiative led by the Office of Economic and Workforce Development (OEWD) to “enhance and strengthen neighborhood commercial corridors around San Francisco” by “improving physical conditions, increasing quality of life, and building community capacity²⁷. IIN Areas are relevant here because by presumably placing Slow Streets close to these commercial areas, the City is expanding access to these businesses by providing not only safe access but also incentive for people to be there.

The Muni Equity Strategy Neighborhoods²⁸ are another indicator of vulnerable areas in San Francisco. Boundaries for these neighborhoods were based on the criteria of “concentrations of households with low income, concentrations of residents who identify

with a race other than white, zero vehicle ownership households, and concentrations of affordable and public housing developments²⁸.” These designated neighborhoods are especially relevant because they indicate neighborhoods where people are more transit dependent. The populations in areas which are deemed priority Equity Areas for Muni would also be relevant for people who could especially benefit from using Slow Streets to travel to essential jobs or services. Thus, during Covid-19, when Muni service is altered or decreased, supporting Slow Streets for essential workers and those needing to travel places is crucial.

The intersection of IIN Areas and Muni Equity Strategy Neighborhoods that are within a 0.25-mile buffer of Slow Streets are indicated in orange and purple in the map below. The areas mapped are only for Phases 1-3, as SFMTA is currently conducting outreach as this piece is being written. As stated, for Phase 4, SFMTA is focusing on historically under-served areas to see if these areas have interest and support for Slow Streets. As shown in **Figure 21**, three neighborhoods in south San Francisco: Bayview, Visitacion City, and the Outer Mission, that SFMTA will conduct outreach to probe interest are all areas which correspond to Muni’s Equity Areas in **Figure 20**.

Table 2 shows that 17.65% of Slow Streets are within 0.25-miles of Equity Areas, designated by IIN and Muni Equity Strategy Neighborhoods. This indicates that 17.65% of the Slow Streets in response to Covid-19 are within .25 miles of “Equity Strategy” or vulnerable areas. In San Francisco, 6.84% of the total land area is considered an Equity Area for this analysis. The proportion of the city with Covid-19 transportation responses is greater (17.65%) than the proportion of the city considered an Equity Area. 17.70% of non-

equity areas are within .25-miles of Slow Streets, while 5.53% of the total Equity Land Areas are within .25-miles of Covid-19 transportation responses.

Table 2. Comparison of San Francisco’s Equity Areas to Covid-19 transportation responses.

	Equity Area/Total area of city	Proportion of Covid-19 response within .25-mi of Equity Area	Non-equity areas within .25-mi of Slow Streets/Total Non-equity area of city	Equity Land Area within .25-mi of Slow Streets/Total Equity Area
San Francisco	6.28%	17.65%	17.70%	5.53%

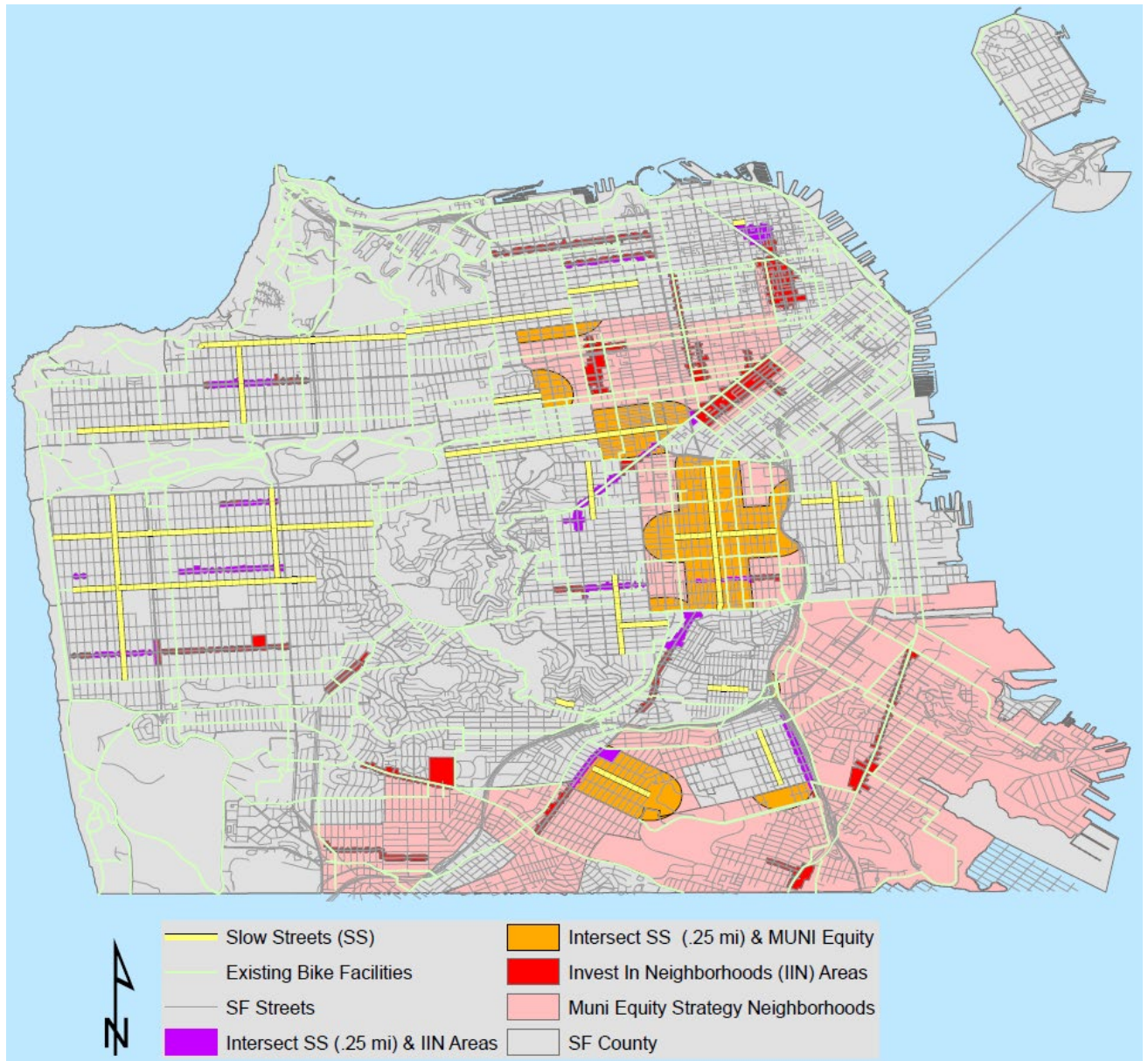


Figure 20. GIS equity map. San Francisco's Slow Streets mapped alongside of existing bike facilities and compared to vulnerable areas, as designated by the City of San Francisco.

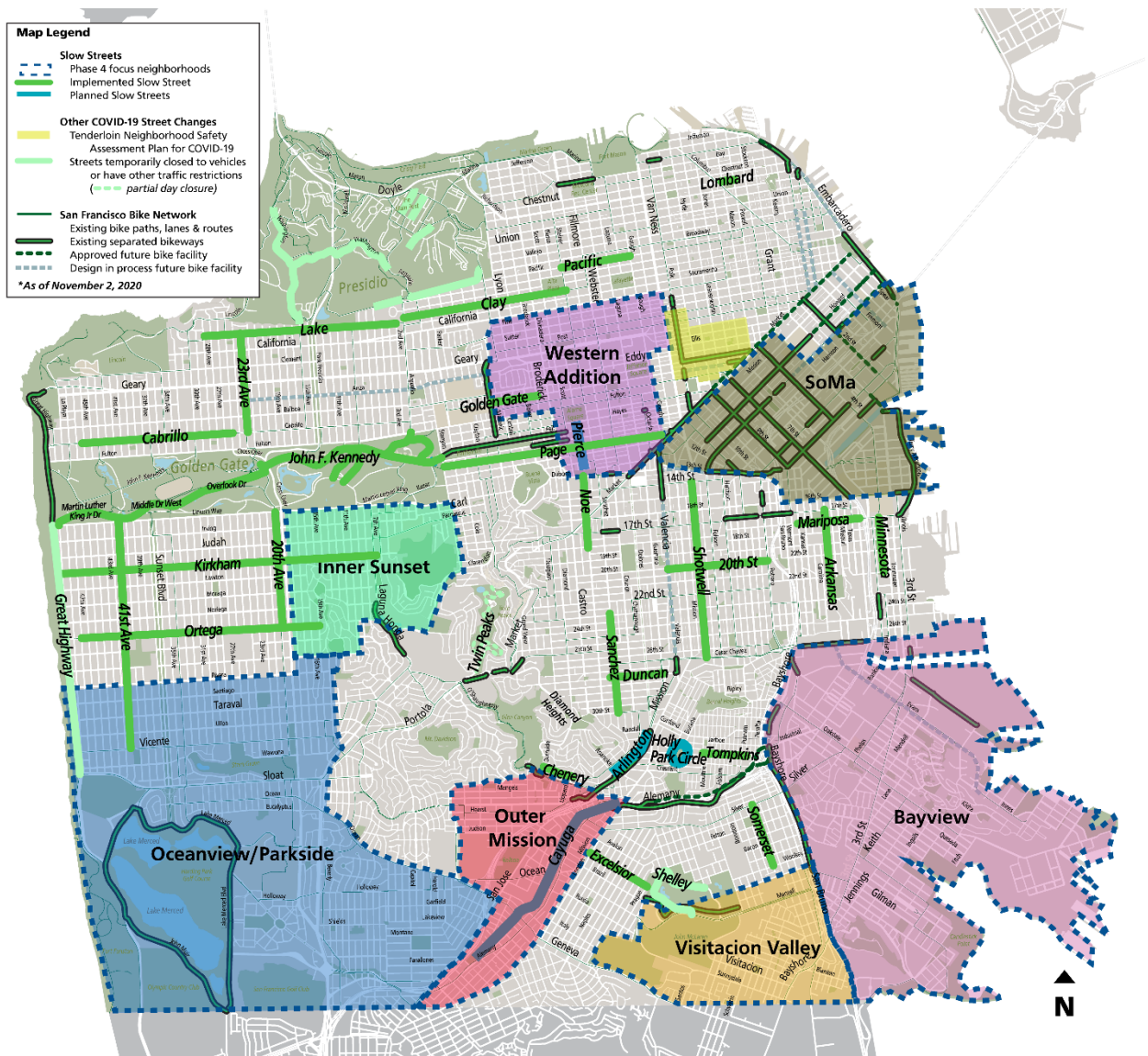


Figure 21. SFMTA's map of Slow Streets showing where outreach will focus for Phase 4 to see if there is interest and support for Slow Street corridors here. (SFMTA, Slow Streets Takes it to the Streets.)

4.3 Case study: Portland

4.3.1 Transportation Response Overview

In response to Covid-19, the Portland Bureau of Transportation (PBOT) in Portland, Oregon initiated what they call “Safe Streets,” which involves making temporary changes to city streets to give people more space to enjoy their neighborhoods outside²⁹. PBOT maintains three main reasons for the Safe Streets initiative during Covid-19: over one-third of Portlanders live in places with no outdoor space of their own, frontline workers need safe ways to commute to work on crowded sidewalks and streets, and businesses need more space to allow enough physical distancing²⁹. The initiative includes several parts: quieter, low-traffic streets, where “neighborhood greenways” are turned into “local access only”; safer busy streets, where PBOT will make changes to provide more space for people on busy streets with crowded sidewalks; and healthier business districts, where PBOT supports their business “main streets” by providing more space for pickups and deliveries.



Figure 22. Slow Street in Portland, Oregon. (@bikeportland)

4.3.2 *Initiating Factors in Covid-19 Transportation Responses*²

Prior to Covid-19, Portland had an inclination for Safe Streets type projects. Portland is a participator in Vision Zero³⁰. Prior to Covid-19, the city had what they called, “Summer Series,” a monthly community bike ride or walk that moved around the city, which has been going on for over ten years. These car-free loops are typically 5-7-mile destinations so that residents can bike around. They are intended to be a local neighborhood initiative for people to learn about active transportation in their neighborhood and to serve as a catalyst for people to see that their city is more connected than they realize³¹.

In terms of tactical urbanism projects, Portland residents had done some of their own guerilla tactical urbanism, such as a guerilla crosswalk painted across a busy street with inexpensive white paint⁴. However, the City had never initiated any tactical urbanism itself³². For instance, this is the first time the City has provided painted curb extensions and other more temporary projects³². **Figure 23** shows the City’s effort at extending a crosswalk at an intersection using simple yellow paint and barriers. Although this is a simple project, it serves multiple purposes: extending the crosswalk creates more space for people

² The researcher conducted an interview with the project lead of the “Safe Streets” program who also serves as a senior transportation planner for PBOT. An additional interview was conducted with coordinator for the “Busy Streets” program who also serves as the pedestrian coordinator for the PBOT. The information in this and the following sections (4.3.2-4.3.5) synthesis of the interviews and online research.

waiting to cross the street, grants pedestrians a shorter crossing distance, and makes pedestrians more visible to vehicles.



Figure 23. Intersection sidewalk extension in Portland using simple paint and barriers. (@PBOT)

Oregon initiated a state directive quickly after it became clear that the Covid-19 crisis was permeating the United States. With the state locked down, PBOT had to decide what to do. PBOT first contended with the fact that PBOT is a transportation agency whose goal is to move people, but the state’s initiative was for people to stay home³¹. At first, some advocated for responding to the pandemic with similar actions as other cities, such as Seattle’s Slow Streets; however, Portland’s leadership was not initially keen on acting. Then, when the state was ready to open back up, the transportation commissioner realized that something needed to happen³¹: Portland was about to start to reopen and people would start moving about again—there needed to be a safe way for people to do this. Thus, PBOT

quickly developed an internal task force with representatives for management and various groups and divisions to be a recommendation body³².

4.3.3 Logistics of Projects

When Portland first started responding to Covid-19, the approval process was less bureaucratic due to the necessity of getting things done quickly³². Because of the accelerated timeline, community input initially was lacking³². However, PBOT is now in the process of doing post-installation evaluations. Through a text-in user survey, PBOT is gathering feedback about whether people are using the new infrastructure, how parking is impacted, and whether some of the Slow Streets should be permanent³². Additionally, the city has committed to providing opportunities for ongoing engagement for Portlanders to share feedback moving forward³³.

Portland, like most other cities, has had to shift their resources during Covid-19. While maintenance crews are a low-cost workforce, they are not always “on board with [Safe Streets] kinds of programs³¹.” Therefore, these maintenance crews have not been widely available to PBOT because they cannot force these people to work on their projects³¹. Political leadership could push them, but they have not. In terms of actual resources for the Safe Streets program, such as barriers, PBOT has been able to use the resources from their Open Street/ Summer Series program that occurred prior to Covid-19. Traffic barriers get placed in the road to narrow the road to cars.

However, the Safe Streets program coordinator stated that barriers do not always do enough and that engineers are conservative in terms of the materials they recommend to control vehicular traffic³¹. PBOT intended the traffic barriers to create a pinch point, but

in many cases, they have not worked as intended and serve more to notify people instead of functioning to decrease the design speed of the road. In terms of staff to work on Slow-Streets projects, PBOT was able to pivot their staff towards working on more Safe Streets type projects: there has not been more work, everyone has just been doing different work during this time³¹. New projects undertaken during Covid-19 were paid for by reprogramming existing small cap budgets allocated for projects already in the queue, which now have been deferred³².

Although initially unsure³² how to handle Healthy Businesses permitting in the winter, Portland has created a detailed plan. The city had a meeting where they grappled with how to handle restaurants and bars spilling out into the right-of-way³². One of the topics discussed was that if the City of Portland allowed businesses to put up outdoor tents, that may be effectively creating indoor space and contributing to the public health crisis³². However, after detailing a specific plan for winter business permitting, the City decided to allow Healthy Business permits in the winter with permitting parameters³². Considering the impending holiday and retail season, the City of Portland wanted to provide an opportunity to operate in the right-of-way out of concern for the health for the business community³². **Figure 24** shows how a street closure has created more space for outdoor dining, while at the same time eliminating the need for pedestrians to wait at a crosswalk. Diminishing crosswalk queuing during the current airborne pandemic lessens the likelihood of people gathering within six feet of each other.

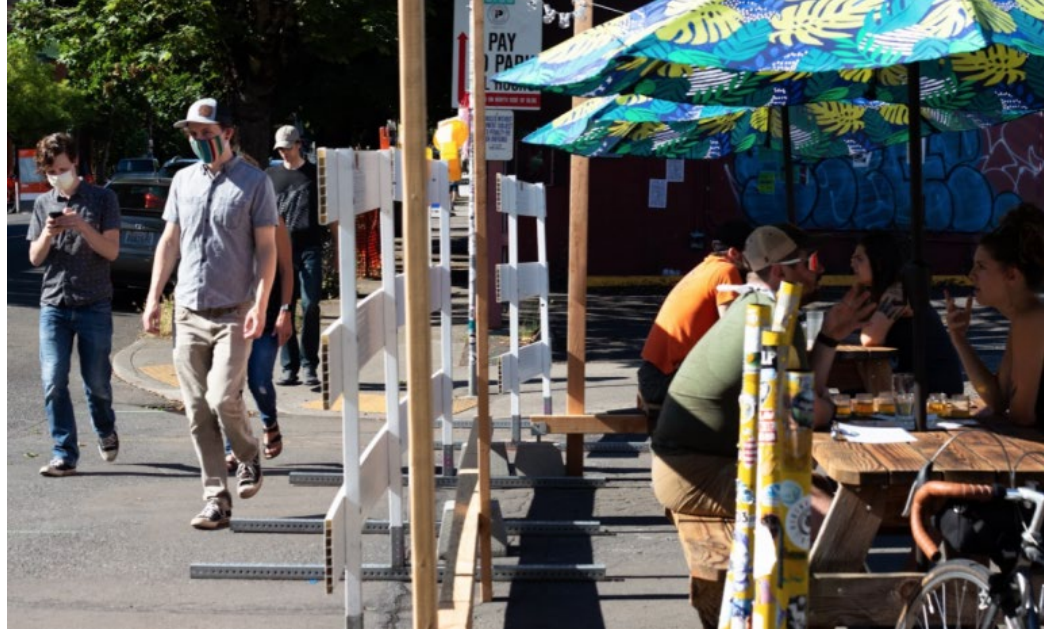


Figure 24. Outdoor dining street closure and elimination of a crosswalk and therefore crosswalk queuing. (@PBOT)

The initial Healthy Business permits expire on November 1, 2020. Therefore, when the city decided to move forward with the “Winter Healthy Businesses” permitting, they made them free and last through March 31, 2021³⁴. PBOT acknowledges that, for the winterized version of Healthy Businesses, businesses will want to make their customers comfortable in the colder weather by providing tents, heating, and more lighting. Businesses who do put up tents and electrical will have to make sure that 6 feet of sidewalk space must is always kept clear for pedestrians and that cords for electricity are safe and ADA-compliant. Additionally, tents can be placed in parking spaces, but not within 50 feet of intersections in order to maintain safety and visibility at the intersections³⁴. PBOT also laid out detailed Winter Healthy Businesses design requirements with standards for different speed-limit streets, parking space use, street plazas using vehicle lanes, as well as winter weather, maintenance, and construction guidelines³⁴. For instance, if a business is

located on a street with a speed-limit over 25 mph, then the business is required to create a Traffic Control Plan with PBOT³⁵. PBOT even has created a webpage for businesses to learn about traffic control and vendors in the Portland area for the traffic control devices³⁶.

4.3.4 Feedback to and Future of Responses

An interesting aspect of the Healthy Businesses program is that business communities are “conservative by nature³¹.” Some business owners shifted to a more auto-dependent model where they altered their whole restaurant business to a delivery and take-out model. These types of businesses wanted quicker pickup and drop-off loading spaces as opposed to more open areas for people to enjoy their food outside. On the other hand, other business owners liked the ideas of streetscape planning on main streets for restaurant customers to enjoy their food outdoors³¹. The two responses of moving towards a more car-dependent model versus moving toward an outdoor-restaurant model are both Covid-19 responses, but they are not necessarily compatible.

Some friction to Safe Streets projects has been towards the “Busy Streets,” where PBOT has created more room for non-vehicles on streets without closing a street entirely to traffic. Reclaiming this space has often come with restrictions on easy auto-mobility and parking³¹. For instance, NextDoor groups have been complaining that they can no longer park in places they could easily park before³¹.

Other pushback has occurred internally when “Healthy Businesses” was first initiated³¹. Healthy Businesses allows businesses to obtain a free permit to use more public space to conduct business: sidewalk, parking, and street space was made available for businesses to allow enough room for the six feet public health guidelines. Upper leadership

at PBOT initially pushed back to Healthy Businesses because they are historically familiar with more oversight, requirements, and community buy-in for such big projects coming from their agency. Since each different planning group was acting in “a lot of different silos³¹,” leadership was not exactly aware of all the details of the Healthy Businesses program³¹.

PBOT found further tensions in the walkable “Main Streets” part of town, where businesses are concentrated. PBOT intentionally did not repurpose walkways here to create more pedestrian space in vehicular and parking lanes because they wanted to leave room for businesses to have outdoor markets and seating³². One tension PBOT noticed was that the places where people needed the most space for walking was also the place where businesses were needing to expand out to the sidewalk for dining space³². When a street only has so much ROW, those in charge must decide who to prioritize.

In the past, Portland had not done any tactical urbanism because of the uncertain nature of it. Now that Portland has done some tactical urbanism, the city is still unsure of the future of tactical urbanism in the city, but these quick-build, preliminary projects are more likely that now tactical urbanism in the city is precented³². Additionally, because more business owners have utilized outdoor dining permits than in the past, many will likely continue to do so in the future, and this may become a more regular part of dining in Portland, especially during mild seasons.

4.3.5 Equity

PBOT stated that they explicitly tried to mitigate resources disproportionately going to affluent parts of the city³². PBOT said that they intentionally focused efforts to more

disadvantaged parts of the city to expand space and right-of-way for pedestrians in east Portland, where a higher percentage of people of color and non-English speaking populations live³². PBOT has also publicly recognized that Covid-19 has “disproportionately impacted communities already most burdened by health disparities” and have adopted the “City of Portland Equity Toolkit for Covid-10 Community Response and Recovery Efforts³³.”

Additionally, PBOT’s Equity and Inclusion program has been working within PBOT to “engage and support community groups on transportation issues specific to the Covid-19 public health pandemic³⁷.” In conjunction with this, PBOT has also worked to develop a two-year Equity and Inclusion partnership focused on Transportation Justice³⁷. For instance, in June 2020, PBOT partnered with Transportation Network Companies (TNC’s) to provide free rides for critical trips, specifically for essential workers, caregivers to older adults, people living with disabilities and other high risk populations, and families needing help transportation groceries and other bulk items³⁷.

Locations of Safe Streets are designated in **Figure 25**, indicated by where the Greenway Advisory signs were placed. Also mapped in light red is vulnerability risk³⁸, as designated by the City of Portland. This specific vulnerability risk analysis identifies census tracts in Portland that have populations with a greater than average susceptibility to changing economic conditions and displacement: populations who rent, belong to communities of color, lack college degrees, and have lower incomes³⁸.

The intersection of vulnerability risk areas that are within a 0.25-mile buffer of Safe Streets are indicated in orange in the map below. **Table 3** shows that 4.61% of the total

amount of implemented Safe Streets in response to Covid-19 are within .25 miles of “Equity Strategy” or vulnerable areas. In Portland, 6.84% of the total land area is considered an Equity Strategy area, yet only 4.61% of Covid-19 transportation responses are in these areas. 18.54% of Portland’s total non-Equity Area falls with .25 miles of Safe Streets, while 12.22% of Portland’s total Equity Area falls within .25 miles of Safe Streets.

Table 3. Comparisons of Portland's Equity Areas to Covid-19 transportation responses.

	Equity Area / Total Land Area	Proportion of Covid-19 response within .25-mi of Equity Area	Non-equity areas within .25-mi of Safe Streets / Total Non- equity area of city	Equity Land Area within .25-mi of Safe Streets / Total Equity Area
Portland	6.84%	4.61%	18.54%	12.22%

It does appear that PBOT has implemented some Safe Street locations in east Portland, where there is a higher proportion of people of color and non-English speaking populations. PBOT did specifically mention east Portland as a focus area for Safe Streets and Healthy Business permitting. This area shows up in orange in the .25-mile vulnerability risk area and Safe Street intersection buffer analysis, but still only 4.61% of the response areas are in vulnerable neighborhoods, which is less than the proportion of all of Portland that falls within Equity Strategy Areas.

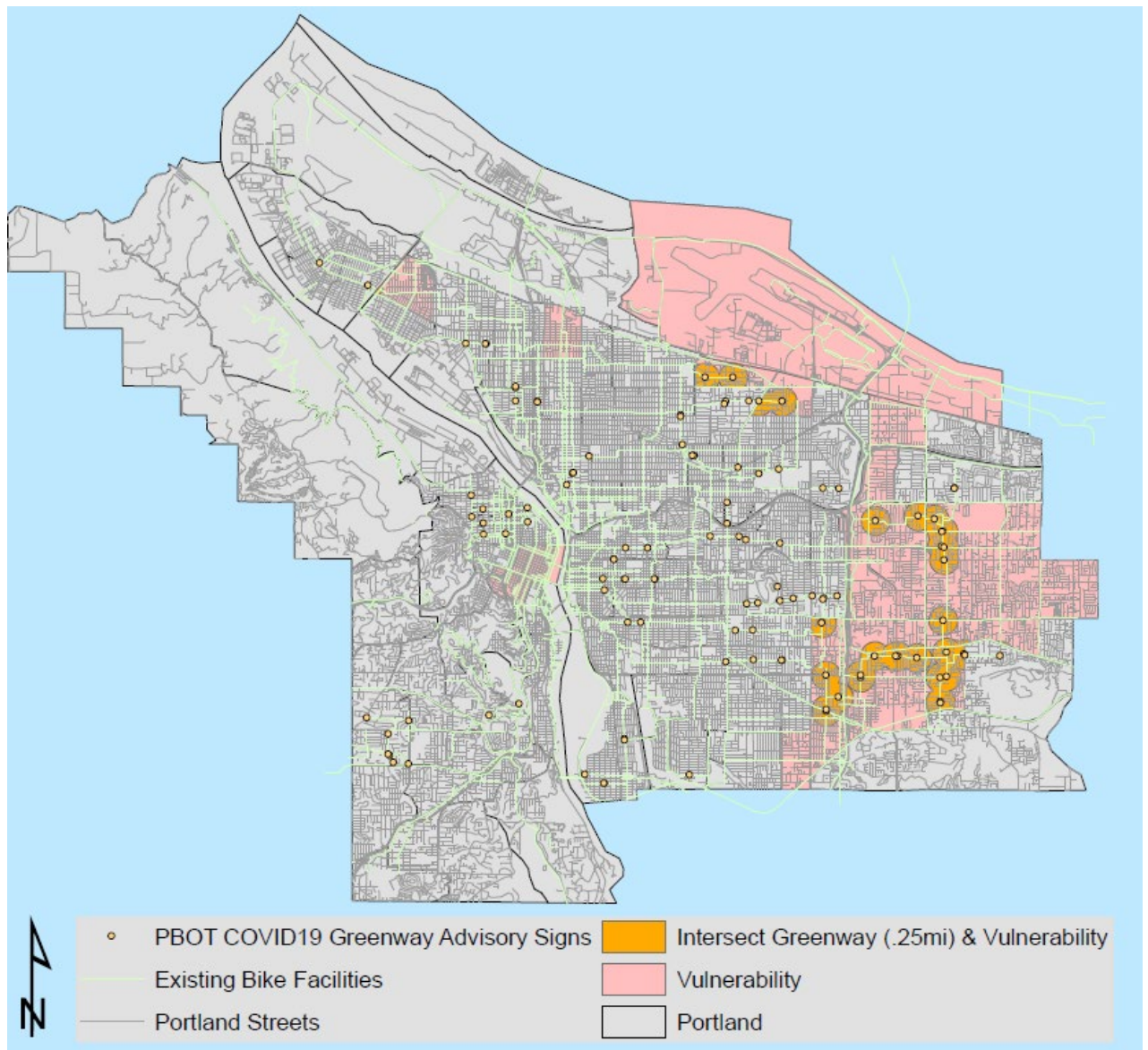


Figure 25. GIS equity map. Portland Greenway Advisory Signs, indicating where the Covid-19 greenway responses are, mapped alongside of vulnerable areas and the bike network.

4.4 Case study: Seattle

4.4.1 *Transportation Response Overview*

Seattle Department of Transportation's (SDOT) transportation response to Covid-19, "Stay Healthy Streets," started with the city upgrading 25 miles of preexisting Neighborhood Greenways³⁹. These were residential streets that had been designated as Neighborhood Greenways through public engagement. These Neighborhood Greenways make walking and biking the priority by calming street traffic with speed humps, 20 mph speed limit signs, wayfinding signs and pavement markings, and stop signs along side streets adjacent to the greenway³⁹. Newly designated as Stay Healthy Streets, now people can walk in the street in order to stay 6 feet away from others, as shown in **Figure 26**. As a residential street, cut-through traffic on Stay Healthy streets is encouraged, but deliveries, waste pickup, and emergency vehicles are allowed.



Figure 26. Stay Healthy Street, one of Seattle’s newly upgraded Neighborhood Greenway. (@SDOTPhotos)

Additionally, SDOT initiated “Stay Healthy Blocks,” where residents, community-based organizations, and non-profits temporarily close a street to create more recreation space while still being able to maintain a safe social distance from others⁴⁰. Stay Healthy Blocks are maintained by residents, community-based organizations, and non-profits. The Blocks are possible on non-arterial streets and can span multiple blocks but not through intersections. Those applying for a Stay Healthy Block are encouraged to talk to their neighbors before applying to avoid conflicts and are responsible for notifying their neighbors of a permitted closure⁴⁰. Additionally, people must provide their own barricades, such as using personal trash bins or furniture or by renting barricades from local partners⁴⁰. Minimum size for Stay Healthy Block “Street Closed” signs are 36” x 24” and are required at either end of a closure⁴⁰. An example of one such block is shown in **Figure 27**.



Figure 27. Stay Healthy Block in Seattle. (@SeattleDOT)

In order to support businesses during Covid-19, the City of Seattle has initiated “Healthy Business Streets,” where businesses are encouraged to “reprioritize public space to aid physical distancing⁴¹.” By following guidelines set forth by SDOT regarding minimum sidewalk widths for pedestrian travel and to comply with ADA standards, the City of Seattle encourages businesses to create Sidewalk Extensions. Figure 28 shows one such sidewalk extension, which has created more space for outdoor dining. For Sidewalk Extensions, traffic cones or other delineators are used to block off a parking or travel lane adjacent to a sidewalk to provide more space⁴¹.



Figure 28. Sidewalk extension serving as a curbside cafe. (@SeattleDOT)

Furthermore, businesses are now able to more easily apply for curbside cafes and market permits to be set up in curbside parking areas. Other creative ideas can be incorporated into these Healthy Business Streets, such 1) side street plazas, 2) shared private parking lots, and 3) swerved sidewalk extensions. Side street plazas are appropriate when a business is adjacent to an arterial that cannot be modified; in this case, a side street may be closed to vehicular traffic in order for tables and seating to be set up at a safe physical distance apart (12' recommended)⁴¹. Restaurants are encouraged to partner with other nearby restaurants to place shared seating in parking lots. Swerved sidewalk extensions not only extend the sidewalk, but slow down cars by design by swerving the travel lanes throughout a block segment; when cars must navigate swerves, they are forced to slow down⁴¹.

4.4.2 *Initiating Factors in Covid-19 Transportation Responses*³

Seattle's inclination for Open Street type policies is exemplified by several traits of the City and SDOT. First, Seattle is a participant in Vision Zero, and as a part of this, SDOT has initiated pedestrian-first crosswalks, sometimes called Pedestrian Leading Intervals (PLIs), where the walk signal turns on for pedestrians before the light turns green for cars. This serves as a safety feature because it grants drivers greater visibility of people in the crosswalk. The city created 250 PLIs 6-months before their goal. Data from Seattle shows that 48% fewer people are hit by cars in Seattle due to PLIs⁴². SDOT has also suggested that they propose a new policy for programming walk signals to give people more time to cross the street and increase the number of automatic walk signals that do not require a pedestrian beg button⁴².

Seattle's predisposition for Open Street type policies is also demonstrated by Seattle's pre-Covid-19 "One City Center" plan, which is a multi-institutional 20-year strategic plan to help the city accommodate and evolve as it has faced unprecedented growth⁴⁸. This plan envisions a world-class transportation network and public space improvements⁴³. Furthermore, the City has adopted the "Imagine Greater Downtown"

³Interviews were conducted with the "Stay Healthy" manager of open streets in Seattle and with the Director of Built Environment for the Downtown Seattle Association (DSA). Much of the information in this and the following sections synthesizes these interviews and online research.

plan, which is a long-term ambitious plan by a coalition of agencies who all have a stake in the future of downtown Seattle: the SDOT, City of Seattle, King County Metro, Sound Transit, the Downtown Seattle Association, WashDOT, and the Port of Seattle. This plan is an agreement between the coalition to serve as a guiding vision, or constitution for the coalition, in focusing on “streets as places for public life as well as movement⁴⁴.”

With these prior Open Street inclinations in mind, during April and May, SDOT conducted outreach about their upgraded Neighborhood Greenways, Stay Healthy Streets, in order to make 20 of these miles permanent. Goals focused on equity, respecting cultural significance, and ways to replace the Street Closed signs⁴⁵. The City quickly decided to make these streets permanently closed to through-traffic.

4.4.3 Logistics of Projects

Additionally, SDOT opened 4 “Keep Moving Streets” to support physical distancing around destination parks. These streets are located on streets with higher speed and traffic volume than Stay Healthy Streets. Keep Moving Streets are temporarily closed to cut-through traffic in order to allow people to recreate close to home safely and keep safe physical distances away from others⁴⁵. Additionally, some parking lots adjacent to parks are closed to reduce crowding in parks. Seattle has also adjusted nearly 800 traffic signals throughout Seattle to reduce the time for people waiting to cross the street. Furthermore, SDOT has made 75% of the pedestrian buttons automatic so that it shows a walk signal whether or not a pedestrian button is pushed⁴⁶.

Attributes in selecting the 25 miles of Stay Healthy streets from Seattle’s 45-mile preexisting Neighborhood Greenway network include avoiding impacts to businesses,

emergency vehicle routes, and transit operations. Additional considerations were not to block essential worker, such as healthcare provider, parking³⁹. Selection also considered Seattle's Race and Social Index³⁹. However, because Covid-19 responses initially were happening very quickly, current and future research will focus more heavily on outreach in more vulnerable neighborhoods than they did initially, in regard to making some of the Stay Healthy Streets permanent

Typically, for project to happen, such as a Neighborhood Greenway, the city of Seattle would do a robust outreach process. During Covid-19, however, an emergency declaration allowed projects to continue in the absence of the intense outreach process that the city usually requires⁴⁷. In terms of resources, the state government instituted general construction bans in various forms. Since the construction crews were at home idle, a lot of labor was available at early stages of the pandemic from these crews⁴⁷. Moreover, many of the necessary materials were already stockpiled, facilitating projects' initiation⁴⁷. In addition to the 20 miles of Stay Healthy streets becoming permanent, the Stay Healthy program manager stated that he would be shocked if the pedestrian button recalls were removed at the end of the pandemic⁴⁷, meaning the automatic pedestrian buttons are most likely permanent. In addition, businesses may end up liking the parking spaces that have been converted to dining and shopping spaces and request to have these more regularly.

Through relaxed outdoor dining guidelines, Healthy Business Streets has helped businesses. These permits are extended until next October 2021, having originally been slated to end by December 2020⁴⁸. Those wanting to use the business frontage space on the sidewalk or in the street must request a Street Use permit from SDOT: these temporary permits are free, flexible options for sidewalk cafes, merchandise displays, and food

vending⁴⁹. To use curb space, businesses must apply for a Temporary No Parking Permit as well as rent or purchase a No Parking barricade. An example of a simple outdoor dining extension into a parking lane is shown in **Figure 29**. If a restaurant wants a more permanent curb-space café installation, they can apply for a different “sidewalk café or streatory” permit,” which have more detailed and complex permit applications and fees associated with them⁴⁹.



Figure 29. Outdoor dining extension into a parking lane in Seattle. (@SDOTPhotos)

4.4.4 Feedback to and Future of Responses

The success of SDOT’s Healthy Business Streets is encouraging or underwhelming, depending on the neighborhood⁴¹. Two examples of successful neighborhoods are Ballard and Capitol Hill. What really contributes to success is when

multiple restaurants on the same street are all participating in extending cafes to the outdoors, creating more of a socially distant “dystopian festival vibe⁴⁸.”

Several reasons contribute to making Healthy Business Streets underwhelming. As an example, the downtown district has not seen the widespread success that some other Seattle neighborhoods have experienced. One contributor is that sidewalk space is narrow while at the same time fostering more pedestrian volumes. Another is that SDOT is trying to avoid taking up sidewalk or ROW space on arterial streets, but most of the streets in downtown Seattle are arterials. Although parks are downtown, the city does not want to see private commerce in park. A third issue is that only a quarter of the 340,000 employees now commute to work in downtown Seattle, due to widespread employee work-from-home policies. The fourth issue is public safety and comfort. Business owners do not feel comfortable with their belongings sitting outside or with asking customers to sit outside. Fewer workers in downtown contributes to less public eyes on the street and more unsheltered people living outside than pre-Covid-19⁴⁸. Considering these complications in downtown Seattle, many restaurants here are only doing takeout, thereby making loading and pickup zones for customers and deliveries even more desired than they were prior to Covid-19. Few Healthy Business permits have been issued here, as loading and pickup zones compete for the same space that the Healthy Business streateries do.

Seasonality does affect the Covid-19 street policies. In order to keep outdoor dining relevant with the changing season, the City is allowing tents, but the state of Washington is only permitting the tents to have two sides so as to treat the tents as an open-air space⁴⁸. However, some are not satisfied with this two-sided tent arrangement because a two-side tent may not protect customers from the extreme wind and rains that Seattle can experience.

Therefore, the city and the state are working together on this issue to figure out a solution⁴⁸.

Figure 30 shows one such creative solution in the form of eating bubble to keep groups of people separate while simultaneously keeping them warm.



Figure 30. A creative winter outdoor dining solution in Seattle. (@MinusPeach)

For the spooky month of October, Seattle enacted “Trick or Street Blocks⁵¹.” In this seasonal rendition of Covid-19 Halloween, Seattle residents can turn a non-arterial block into a Trick or Street Block for Halloween by obtaining a free permit from the City to host this socially distanced event. Those who already live on a designated Stay Healthy street do not have to obtain another permit or new “Street Closed” signs for their socially distanced Halloween street⁵¹.

The City of Seattle already had ambitious plans to make their city more bicycle, pedestrian, and people friendly, as exemplified by their One City Center and Imagine

Greater Downtown plans. As a long-term vision, the kinds of projects that have been necessary during Covid-19 will most likely help to accelerate these⁴⁸. For instance, a bike lane that was supposed to be built in 2021 has already been built because of Covid-19⁴⁸. Usually faced with some type of opposition, business-owners and others adjacent to the would-be bike lane could clearly see the value of having a bike lane in front of their storefront, and the bike lane was built with little opposition, presumably due to Covid-19⁴⁸. The unopposed bike lane is an example of how the Imagine Greater Downtown plan may be accelerated by the kinds of projects accompanying Covid-19.

This is not to say that those Imagine Greater Downtown coalition members are currently implementing an inordinate amount of projects—Seattle is facing budget constraints, as are most cities—but rather that Covid-19 is giving Seattle a shared opportunity to experiment with already formed ideas⁴⁸. What can be done in the ROW is an additional way in which Covid-19 projects may affect the vision of Seattle as a city. The state of Washington has a lot of prohibitions about what can happen in the ROW, and many of these prohibitions have been relaxed during the current pandemic, such as with the Healthy Business Streets program⁴⁸. Successes attributed to current relaxed ROW policies may affect the State of Washington’s long-term ROW prohibitions.

4.4.5 Equity

SDOT considered the Race and Social Index⁵⁰ to determine which neighborhood greenways to upgrade to Stay Healthy. The selected greenways “served areas of dense housing or limited public open space, geographic coverage, and access to essential services and open businesses⁵¹.” The Racial and Social Equity Index combines race and ethnicity

demographics with socioeconomic data and health disadvantages “to identify where priority populations make up relatively large proportions of neighborhood residents⁵⁰.” In the City’s outreach efforts to gather input on making more of the streets permanent, their efforts will center on race and equity and “how to respect the cultural significance of neighborhoods to those that live there⁵¹.” Relatedly, the city has also stated that the “car free streets were selected to amplify outdoor exercise opportunities for areas with limited open space options, low car ownership and routes connecting people to essential services and food take out⁵².” Through these statements and Stay Healthy street selection, it seems the city has explicitly considered and intends to continue considering equity in their project decisions.

Locations of Stay Healthy Streets are visualized in **Figure 31**, indicated by yellow lines. Mapped in light red is Seattle’s Racial and Social Equity Index. The intersection of Equity Areas that are within a 0.25-mile buffer of Stay Healthy Streets are indicated in orange in the map below.

Of the four case study areas, Seattle has the highest proportion of Covid-19 transportation responses in areas with vulnerable populations, with 34.64%, as shown in **Table 4**. Compared to the 23.94% of the city’s total area being an Equity Area, the proportion of Covid-19 responses within .25-miles of Equity Areas is greater. **Figure 31** shows Seattle’s Stay Healthy and Keep Moving Streets mapped alongside of the Racial and Social Equity Index. With a .25-mile buffer around the Stay Healthy and Keep Moving Streets, 34.63% of these Covid-19 street responses lie with .25-miles of Equity Areas. 17.18% of Seattle’s total non-Equity Area falls with .25 miles of Stay Healthy and Keep

Moving Streets, while 28.92% of Seattle’s total Equity Area falls within .25 miles of these Covid-19 transportation responses.

Table 4. Comparison of Seattle’s Equity Areas to Covid-19 transportation responses.

	Equity Area / Total area of city	Proportion of Covid-19 response within .25-mi of Equity Area	Non-equity areas within .25-mi of SHS & KMS Streets / Total Non-equity area of city	Equity Land Area within .25-mi of SHS & KMS / Total Equity Area
Seattle	23.94%	34.63%	17.18%	28.92%

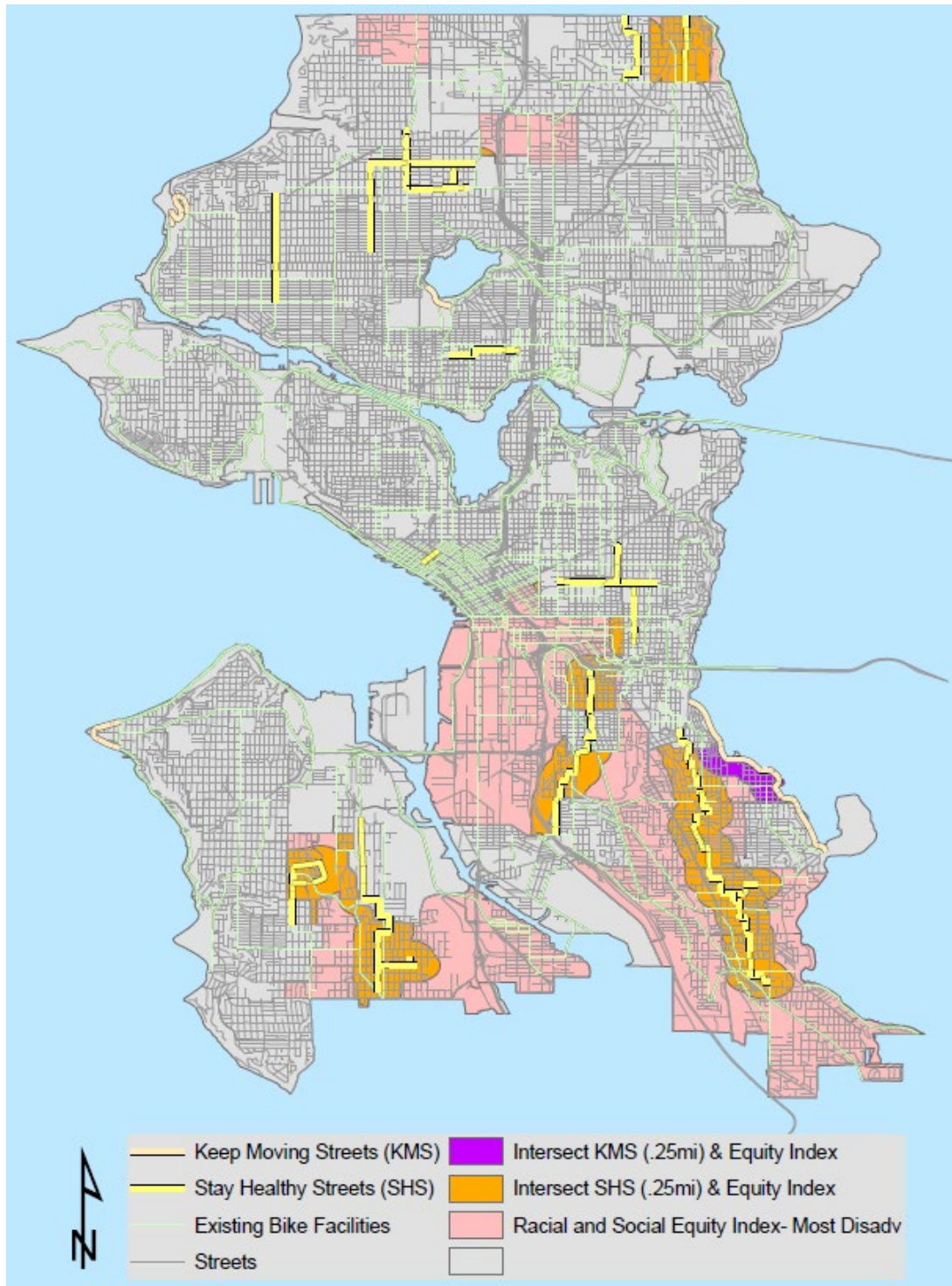


Figure 31. GIS equity map. Seattle's KMS and SHS mapped alongside of the Racial and Social Equity Index, as designated by the City of Seattle.

4.5 Case Study: Toronto

4.5.1 *Transportation Response Overview*

ActiveTO is Toronto Transportation Services (TTS) transportation response to Covid-19 to ensure “that people have space to get around while respecting physical distancing⁵³.” Locations are selected based on population density, equity, access to greenspace, and traffic volumes⁵³. Initiatives in Toronto include Quiet Streets, Closing Major Roads for active transportation, and Expanding the Cycling Network. The CaféTO program facilitates outdoor dining, and a RapidTO program installs Bus Rapid Transit (BRT) lanes.

Quiet Streets close streets to through-traffic in order to give more space to people to be outside and maintain social distancing, as demonstrated in **Figure 32**. The program was terminated in October, as signs and barricades were temporary and are unable to last through the winter season, with snow vehicles clearing the street and the weather being harder on the signs⁵⁴. The city of Toronto is preparing a report based on feedback collected through a survey, through emails, and traffic count data. The report is intended to share lessons from ActiveTO’s Quiet Streets and CaféTO in order to consider reintroducing these programs.



Figure 32. Toronto's Quiet Street. (@OurGreenway)

Closing Major Roads for active transportation involved closing major roads adjacent to parks during certain weekend hours, specified by the City of Toronto. These projects lasted through October 2020. The City of Toronto responded to the overcrowding of popular recreational trails, especially on warmer weekends, by closing major roads on weekends and holidays to allow for more physical distancing⁵⁵.

Expanding the Cycling Network as a part of the ActiveTO program is intended to allow people to bike around Toronto safely, to better connect those on bikes to essential places, and to mirror major transit routes⁵⁶. The discussed plan is the “largest one-year expansion of on-street bike lanes ever in Toronto.” The bike lanes are being installed with temporary designs, such as repurposing curb lanes along several key corridors. By using temporary materials, not only are the projects able to be installed faster, but they can also be adapted and adjusted based on changing traffic volumes and the evolving needs of

residents and businesses⁵⁶. A temporary bike lane with barricades and purple paint is shown in **Figure 33**.



Figure 33. Accelerated temporary bike lane in Toronto. (@TO_Transport)

The CaféTO program aims to increase dining areas outside for restaurants and bars to give more physical distancing space. The program has been extended through the winter, allowing café dining expansion on the sidewalks. While dining in the curb lanes was permitted in the warmer months, Toronto will not permit this through the winter, as it would affect how winter vehicles clear snow, thus affecting accessibility⁵⁷.

4.5.2 Initiating Factors in Covid-19 Transportation Response⁴

During the initial stage of Covid-19, much of the northeast of the U.S. went into serious lockdowns in Mid-March, and Toronto did as well. At this time, most places besides essential services were closed, and the city advised that everyone go home and only leave for essential trips. Therefore, TTS initially did not respond because the advice from Toronto's Medical Officer of Health was to do nothing and limit contact. However, inaction changed to action when the essential services, such as grocery stores and pharmacies started to limit capacity and people were queuing on the sidewalks. The business districts in Toronto, where the essential services are located, generally have 5-foot-wide sidewalks; thus, people have no space to both walk and queue while staying 6 feet away from others. This initiated Toronto's first response, CurbTO, in order to create pedestrian queuing space on the road ⁵⁸.

Around the same time that CurbTo was initiated in April, Toronto started to see enough declines in Covid-19 cases that the City started to allow more places to open. Therefore, the mayor directed the City Staff and the Toronto Transportation Office to initiate a larger, more comprehensive transportation response to accompany more places opening⁵⁸. This materialized in a program with 3 pillars called ActiveTO: 1) weekend

⁴ An interview was conducted with the Cycling and Pedestrian Manager for the City of Toronto. Much of the information in this and the below sections (4.5.2-4.5.5) synthesizes this interview and online research.

major road closures focusing on physical and mental health along existing trails with concerns about overcrowding, 2) quiet streets where barricades and signs were placed in order to prevent through-traffic and slow traffic on 44 miles of neighborhood roads, and 3) cycling infrastructure acceleration with 15 extra bikeway miles to add to the 10 miles Toronto was already adding to the city in 2020. To select the projects, TTS designed the locations of Quiet Streets in tandem with the cycling infrastructure, whenever possible, not only by connecting the two, but also by attempting to place Quiet Streets especially where cycling projects were not possible⁵⁸.

4.5.3 Logistics of Projects

In order to fund these projects, Toronto struggled less than the other three case study cities. TTA has \$16 million a year for dedicated cycling projects and \$2 million for pedestrian projects. The staff size is usually not large enough that they are able to spend all the money. Therefore, TTS was able to spend their own, already allocated, money on the projects enacted during Covid-19⁵⁸. In addition to this, TTS had an easier time because, unlike many American cities, the province of Ontario did not build highways into downtown⁵⁸. Thus, TTS does not have to deal with the province owning some of the roads they are trying to work on like American cities often have to do with the state owning some of the roads in city centers.

In terms of the approval process for the additional cycling infrastructure, Toronto Transportation Services has delegated authority, as opposed to strong-mayor, meaning the Transportation Services answer to a council rather than a mayor⁵⁸. Everything that happens in the road, including cycling infrastructure requires by-law approval from the province

Ontario through the council process. To approve projects such as the bikeways, Toronto typically must get a recommendation from a smaller committee to the Council, who either endorses the project or not. However, during Covid-19 the Council was only hosting special meetings, so the cycling infrastructure moved directly to a full Council meeting without the first committee recommendation step. In May, Toronto requested delegated authority to change the roads, which the Transportation Services only does sparingly, and the City received this authority⁵⁸. Having delegated authority afforded Transportation Services the trust to do a good job in expediting the cycling infrastructure projects without having to first do the design work and public engagement before going to council. In June, the additional 15 miles plus the existing 10 miles of bikeways started rolling out.

Although TTS may have bypassed some public engagement for the projects, many of the projects were near-term projects, so they were slated to go to Council soon anyway. Thus, much of the public engagement process had been done for the bikeway projects chosen to be accelerated during Covid-19. Toronto adopted a cycling network plan in 2019. As a part of the plan, TTS selected specific corridors that have an extremely important significance in the cycling network: many of these corridors are long cross-city arterial roads that are essential in connecting parts of the city⁵⁸. Approval was also facilitated because the projects are being built with more temporary materials, not only to speed up the building process, but also because the bikeway projects have approval to be installed only through 2021. Then, TTS will go back to Council to report what was observed, what were the results, and what TTS recommends moving forward: keep projects, keep with changes, or remove projects.

Some of the Covid-19 selected bikeway corridors already had previous attempts in Council but were not approved. For instance, University Avenue, a selected accelerated bikeway corridor, had gone to Council in 2010, but failed by one Council vote, mainly for political reasons⁵⁸. This time, the corridor was an obvious choice because University Avenue connects 4 hospitals, all with essential workers. To add to this, a recent survey showed that an “astronomically large” number of hospital staff were biking to work⁵⁸. Thus, it was not difficult to argue in favor of expanding bike infrastructure on University Ave for hospital staff, deemed essential workers during Covid-19⁵⁸.

To install the bikeway projects, Toronto mainly utilized paint. The City had an existing paint contact where they typically painted buffers of hatched transverse and linear traffic lines between vehicular and bicycle traffic. For these accelerated ActiveTo bikeway projects, Toronto did not install the pavement markings like normal because this would take too long; TTS went with just the linear lines. Additional ways to accelerate the projects included 1) not changing where the center line was to bypass having to do traffic control during construction and 2) not doing full removals of cycle shared lane markings when present⁴. When the projects go to Council in 2021, TTS will be able to provide results and recommendations based off these more short-term infrastructure solutions. At this time, TTS will spend the time to install these projects permanently, more aligned with typical Toronto standards⁵⁸.

4.5.4 Feedback to and Future of Responses

Public support varies based on the type of project. ActiveTO’s Major Road Closures were overwhelmingly popular with some consternation, especially towards the

end when traffic started increasing. For instance, 20,000 people used just one of the corridors. These road closures were not like an “Open Streets” event which generally occur on storefront streets but were on “car sewers” that have very limited businesses and access. Thus, the major road closures did not impact delivery access for small local businesses⁵⁸.

Public reactions to the Quiet Streets were more mixed and depended on context and community. Some routes were loved, and some were not, and this difference “truly depended on individuals on the street” and whether or not a community took ownership of the Quiet Street⁵⁸. The Quiet Streets faced more “question and concerns” in the more suburban neighborhoods of Toronto⁵⁸. With a staff of only 16 handling all the ActiveTO projects, the cycling and pedestrian team at TTS acknowledges that they conducted little public engagement around the projects because of time and communication constraints due to Covid-19⁵⁸. They are, however, actively seeking feedback from residents, as demonstrated in **Figure 34**.

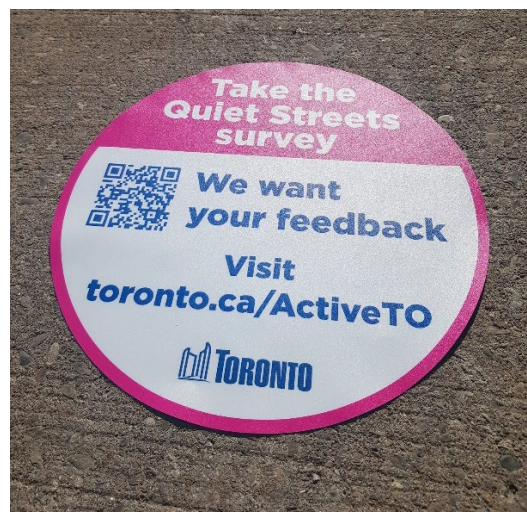


Figure 34. Toronto seeking feedback to ActiveTO through sidewalk signs. (@TO_Cycling)

Moving forward, it is likely that the transportation response to Covid-19 will inform the desires from the Council. Major Road Closure have a high likelihood of continuing seasonally, and Quiet Streets serve to spur interest in traffic calming and how traffic is managed⁵⁸. Additionally, the utilization of temporary materials in cycling projects will help the City figure out how to better experiment in their use of traffic materials for projects. Moreover, during Covid-19, the City has seen “unprecedented political and community support for more cycling infrastructure⁵⁸.” Past criticisms of cycling infrastructure may shift as people begin to use and see the cycling projects, and the process for making the projects happen may change some of the practices.

4.5.5 Equity

The City of Toronto stated that their ActiveTO Quiet Street locations “were prioritized based on several factors including population density, equity and access, access to greenspace, nearby attractions, traffic volumes, and other considerations⁵⁹.” Additionally, Toronto has long-term permanent projects meant to address vulnerable populations and disinvestment by government⁵⁸. The cycling and pedestrian manager states that Toronto most likely did not hit all their equity goals, but that the approach is just as important as the project itself⁵⁸. Toronto has an incredibly large immigrant community, and understanding cultural context is extremely important in these areas. Thus, while Toronto may not seem to be addressing vulnerable communities with ActiveTO, Toronto has other projects in place to do so, and perhaps in a more appropriate way.

Toronto’s Neighborhood Equity Score⁶⁰ is a part of the city’s Wellbeing Toronto Initiative⁶¹, which is meant to measure neighborhood wellbeing over time and to identify

at-risk communities. This area is shown in light red in **Figure 35**, while the intersection of vulnerability risk areas that are within a 0.25-mile buffer of Quiet Streets and Major Road Closures are indicated in orange.

In Toronto, 15.6% of the Quiet Streets and Major Road Closures in response to Covid-19 are within .25 miles of vulnerable communities, as shown in **Table 5**. In Toronto, 29.93% of the total land area is considered a highly vulnerable area, yet only 15.6% of Covid-19 transportation responses are in within 0.25 miles of these areas.

Table 5. Comparison of Toronto’s Equity Areas to Covid-19 transportation responses.

	Equity Area/Total area of city	Proportion of Covid-19 response within .25-mi of Equity Area
Toronto ⁵	29.93%	15.60%

⁵ San Francisco, Portland, and Seattle have two extra comparison numbers than Toronto does. This is because the data sources for each specific city were different, and the researcher was not able to calculate the same comparisons with the data available for Toronto.

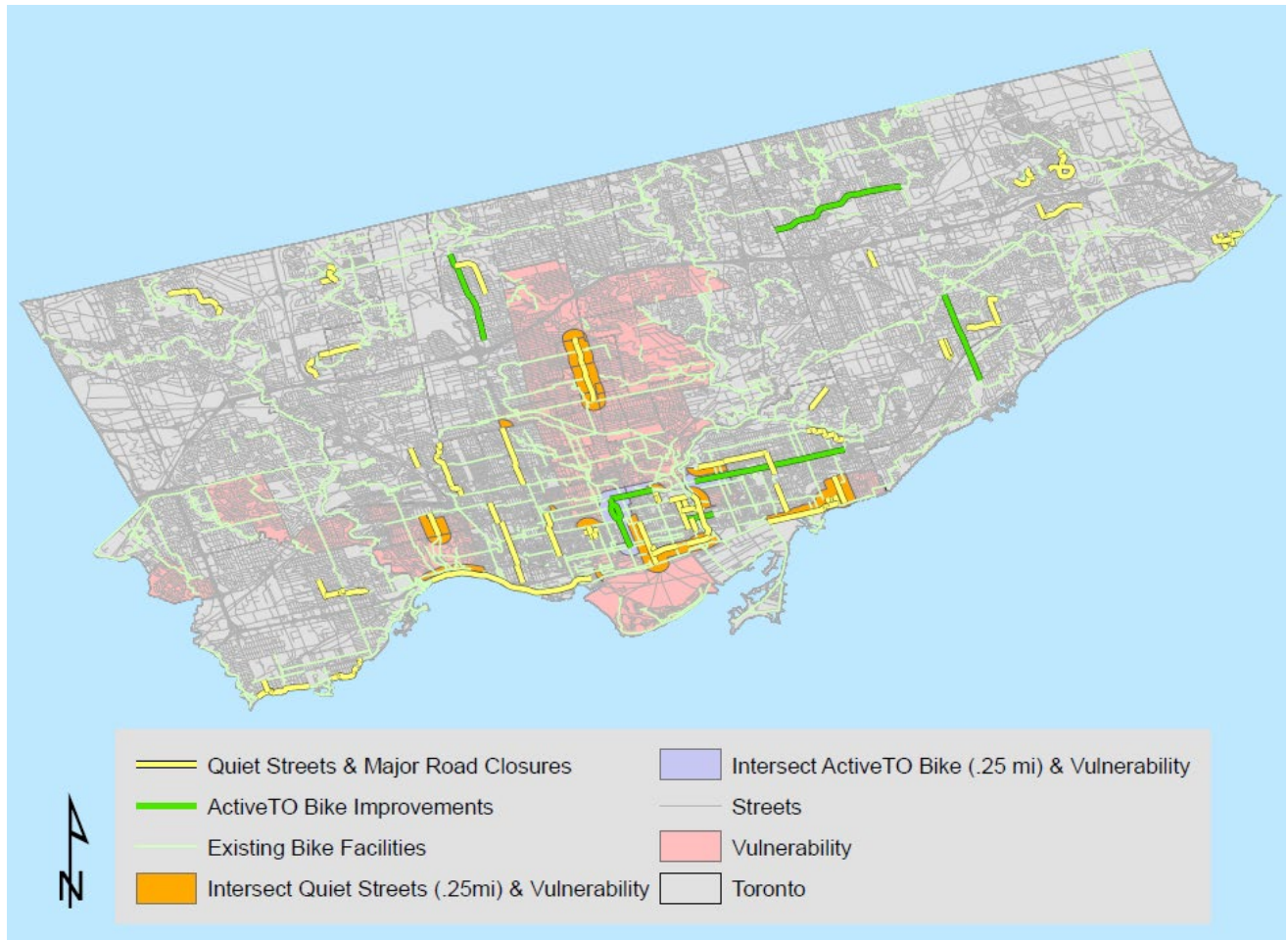


Figure 35. GIS equity map. Toronto's Quiet Streets and Major Road Closures mapped alongside of vulnerable neighborhoods, as designated by the City of Toronto, and existing bike facilities.

4.6 Summary of Results

Table 6 summarizes the main points the author was attempting to address throughout the study, while **Table 7** summarizes the comparison percentages of Equity Areas and Covid-19 transportation responses.

Table 6. Summary table of Case Study Cities.

	San Francisco	Portland	Seattle	Toronto
Propensity for people-friendly transportation projects	Transit First policy. Vision Zero. All stoplights have PLIs.	Vision Zero. PLIs at new/upgraded traffic signals on High Crash Network.	Vision Zero. Many intersections w/ PLIs. Long-term city plan w/ focus as streets for public life	Vision Zero. Yearly dedicated cycling and pedestrian project budget of \$16 million & \$2 million, respectively.
Approval Process	Little outreach. Quick action. Phases 1-2 easily approved during emergency authorization. Phase 3: delayed by CEQA appeals. Phase 4 outreach in process.	Quickly developed internal task force when initial state lockdown was ending. Approval process less bureaucratic. Not much community input initially.	Emergency declaration allowing projects to continue in absence of usual robust outreach process.	Directive from mayor for TTS to initiate a comprehensive transportation response. Requested and received delegated authority to change the roads. Bypassed usual public engagement.

Response Types			<p>Stay Healthy Streets: upgrade 25 mi of neighborhood greenways to designated space explicitly allowing walking in streets.</p> <p>Stay Healthy Blocks: close non-arterial streets for rec. space.</p> <p>Keep Moving Streets: temp close streets around parks to through traffic.</p> <p>Healthy Business Streets: free outdoor dining permits</p> <p>Ped recall buttons: 75% made automatic.</p>	<p>ActiveTO (overarching name).</p> <p>Quiet Streets: close to through traffic.</p> <p>Closing Major Roads: close roads adjacent to parks during wknd hrs. Lasted through Oct. 2020.</p> <p>Expanding the Cycling Network: expediate expansion of on-street bike lanes using temp materials.</p> <p>CafeTO: allows cafe expansion on sidewalks during warm & cold months. Expand to curb lane warm months only.</p>
Challenges	<p>Enough resources for Slow Streets. Phase 3 stalled due to CEQA appeals. Reiteration that Slow Streets are intended for essential trips, not gathering points.</p>	<p>Incompatibility of business models shifting to auto-dependent, pick-up model versus street dining model. Complaints about Busy Streets restricting easy auto-mobility</p>	<p>Downtown: narrow sidewalk space not conducive to Healthy Business Streets; most streets arterials (where SDOT doesn't want to take up ROW); less people going to work dt now, public safety/comfort</p>	<p>Enough staff to manage the many projects. Quiet Streets approval was mixed, depending on context and community (more concerns in suburban community).</p>
Outreach	<p>Post-installation Phases 1&2 user survey (6k responses 78% approval). Phase 4 outreach in targeted neighborhoods</p>	<p>Post-installation text-in survey to assess usage, parking impacts, and potential permanence of Slow Streets</p>	<p>April & May outreach to make 20-miles of Slow Streets permanent. Online Survey (9k responses).</p>	<p>Many of bike projects had previous outreach. Little public engagement of new projects during.</p>

Future	Consideration of making some Slow Streets permanent. Each would be own Quick-Build multi-year long process.	May now try more tactical urbanism projects. Potential permanence of some Safe Streets.	20 miles Stay Healthy Streets permanent.	Temp cycling infrastructure in place until 2021, when it will be formally assessed by Council. Some will be made permanent. Major road closures likely continuation.
---------------	---	---	--	--

Table 7. Summary of all case study city comparisons of Covid-19 transportation responses to Equity Areas.

	Equity Area / Total area of city	Proportion of Covid-19 response within .25-mi of Equity Area	Non-equity areas within .25-mi of Covid-19 Responses / Total Non-equity area of city	Equity Land Area within .25-mi of Covid-19 Responses / Total Equity Area
San Francisco	6.28%	17.65%	17.70%	5.53%
Portland	6.84%	4.61%	18.54%	12.22%
Seattle	23.94%	34.63%	17.18%	28.92%
Toronto	29.93%	15.60%	-	-

4.7 Discussion of Results

This project was a general study of city agency responses to Covid-19. Aspects considered were how and why cities responded, as well as who was involved in different responses. Case studies of four cities aimed to discover and touch on nuances of Covid-19 transportation and street responses. Special attention was paid to a city's prior inclination to Open Street type policies and to how a city's vision may have shifted or been accelerated due to tactical urbanism projects and relaxed permitting guidelines during Covid-19.

This researcher found that cities generally had to act quickly in response to Covid-19 and the changing and uncertain nature of the pandemic. Typical bureaucratic steps which allow projects to happen were relaxed, especially initially and sometimes under Emergency Response declarations, such as in San Francisco, in order to expediate projects. The type of project dictates a city's intended use for it, whether it be an accelerated bicycle lane, quiet street, or closing a major road for active transportation. All four case study cities embraced some combination of their Covid-19 transportation responses being for recreation and essential trips. San Francisco has emphasized the "essential trip" use for their Slow Streets, while Seattle, Portland, and Toronto have embraced their streets as places for residents to recreate and to commute for essential trips, depending on the type of project. Seattle has encouraged community-led streets and even announced a seasonal addition to their streets for Halloween, Trick or Streets. These novel, people-friendly street responses which have been quickly approved helps demonstrate to practitioners that with enough push and momentum, seemingly atypical projects are possible.

Covid-19 has created a precedent for these active transportation, people-friendly projects which, prior to the current pandemic, were nonexistent or slated for years later. If the transportation agencies of San Francisco and Toronto want to make permanent their Slow Streets and temporary expedited bike lanes, respectively, both cities will have to go through their normal approval process to do so. Therefore, even though transportation practitioners must bring projects through their typical, formal approval process to become permanent, the pandemic has essentially put them on the near-future docket. Furthermore, the Quick-build and temporary expedited processes have facilitated scenarios where residents are able to explicitly see, use, and comment on tangible projects, instead of drawing on project mockups a couple of times in a crowded room, tired after a day of work. Relatedly, this allows practitioners to edit and adapt their projects, allowing the more permanent version to be a better iteration of itself.

Some Covid-19 initiated projects will subside when the pandemic dwindles, while others will affect cities long-term. Seattle conducted outreach and harnessed the momentum from Covid-19 to make permanent 20 miles of their Stay Healthy Streets. Portland, which had never conducted any tactical urbanism projects before, may begin to experiment more with this in the future. It is likely that without Covid-19, these cities would have progressed in their current trajectory; these 20 miles of streets would not be permanently closed to residents in Seattle, and Portland would not have experimented with tactical urbanism. Due to Covid-19 and its effects, Seattle accelerated a bike lane expedited by one year, and Toronto quickly built temporary bike lanes, many of which will go through a more formal and permanent approval process in the coming months. These

instances further demonstrate that people-friendly projects have been sped up during this time in order to provide spaces to those moving in the streets.

As time passed and the pandemic persisted, cities have attempted to support businesses through relaxing permits for sidewalk and curb-side dining and allowing outdoor merchandise setups. Cities have extended permit lengths from their initial end dates in order to accommodate continued social distancing public health guidance. However, local businesses still suffer, and many have closed due to Covid-19. As people are vaccinated, and people and businesses can resume more typical operations, cities will likely need to continue providing creative options, such as those provided during Covid-19, to help sustain businesses. Moving forward, business owners may see the value in repurposing space they previously coveted as best-use-for-cars space to space for people not encompassed by a vehicle.

All cities cite budget constraints and postponement of other projects in order to make Covid-19 response efforts possible. Moving forward, city transportation agencies will have to contend with unexpected budgets and changed timelines for projects. Transportation projects involve many moving parts and people to implement; thus, practitioners will likely have to work hard to coordinate and rework a city's projects and plans. As cities rework projects that have been postponed during this time, perhaps practitioners will more readily adapt projects to include people-friendly design.

Exactly who the Covid-19 transportation responses are reaching is a crucial part of the responses themselves. All four of the case study cities include equity discussion or action in their Covid-19 plans. San Francisco noticed that little response came from many

sections of the city, and so the City is specifically seeking input from these neighborhoods for the Fourth Phase of Slow Streets. Portland has explicitly reached out to east Portland, which has a higher percentage of people of color and non-English speaking populations³¹. Seattle has used their Race and Color Index in their selection of Healthy Streets. By using an Equity Index and the locations of Slow Street projects for each city, the included maps (Figure 20, Figure 25, Figure 31, Figure 35) explore and discuss exactly where the Covid-19 street projects are in relation to diverse areas of each city.

The proportion of a city's Covid-19 response area that fell within a 0.25-mile buffer of each city's Equity Area, was calculated. Seattle had the highest proportion of their transportation response in Equity Areas, with 35%, followed by San Francisco's 18%, Toronto's 16% and Portland's 5%. San Francisco and Seattle both had greater proportions of their Covid-19 transportation responses in Equity Areas than total citywide equity land area, while Seattle and Toronto had proportionally less of their Covid-19 transportation responses in Equity Areas than total citywide equity land area.

Although these percentages are useful, they do not encompass the whole picture of what is happening. Responses in general are nuanced and community- and context-specific. However, vulnerable populations, who tend to rely more heavily on transit for their essential trips, must be supported, all the time, but even more so during Covid-19, when transit routes have been decreased. Many of the transportation responses touted intentions of their projects to support safe essential trips. However, it is arguable that vulnerable populations should have been supported even more, as the city with the most support of Equity Areas was still only 35%.

This study has a few limitations. First, only western US cities were involved in the case studies, with one eastern Canadian city. This is partly due to unresponsiveness in other parts of the country and partly because these cities had generally more transportation and street responses to Covid-19 than other places. Second, the researcher would have liked to interview more people from each city to provide the research with more nuanced perspectives. For instance, the researcher would have liked to talk to the San Francisco Bicycle Coalition and Chamber of Commerce in San Francisco in order to obtain advocacy and business perspectives to SFMTA's and the City's response. One of the limitations with the equity maps was that the researcher chose to use each city's respective equity index. Each city had slightly different criteria for their equity analysis, and so the maps cannot be totally compared in parallel.

It is important to note that the country is still in the midst of Covid-19 and that this study's results and conclusions are constricted in their static nature. They still serve as relevant research to help planners, engineers, business associations, practitioners, and generally those who are curious, but the dynamic and long-term nature of the pandemic will surely deem some of this research antiquated.

Future efforts would benefit from including more geographically diverse cities and interviewee perspectives. Nuanced discussions with more community members would greatly benefit this research, as well as feedback from users of the Covid-19 transportation responses. Specific pandemic-related design considerations to serve as guiding principles for cities would also be of benefit in future research. Furthermore, as the current pandemic subsides and city transportation agencies return to more "typical" operations, future research could center on how Covid-19 may have altered typical operations or the

trajectory of the kinds of projects a city undertakes. Lastly, there could be an entire research project focusing solely on the equity aspects of this research. This could include how the existing bicycle facilities connect to Covid-19 Open/Slow street projects and to bus routes and bus stops, as well as explicitly analyzing how more transit-dependent populations are served during such a crisis.

CHAPTER 5. CONCLUSIONS

Covid-19 is affecting cities and towns globally. With such varied responses nationally and internationally, there is not a one-size-fits-all solution, as there rarely is in city planning and civil engineering topics. Appropriate responses depend on a place's culture, geographic location, and prior inclination to certain kinds of transportation responses. What is clear, is that with expanded working from home and virtual schooling, people need places besides their homes to safely exist. Open Streets serve as havens for kids, teenagers, adults, and the elderly to safely recreate in their neighborhood or to safely travel by foot or bike to their essential jobs. Expanding and relaxing permitting guidelines for outdoor dining and merchandising has become a helpful tool and lifeline for some businesses. Business-owners and customers alike have seen the benefits of "Streateries"; cities have noticed this, extended the length of permits, and have thoroughly laid out winter outdoor dining guidelines. At the same time, while open streets are positive for many, it is important for city officials, planners, and engineers, to strategically consider nuanced ideas and solutions depending on the community. Some communities of color will, in a lot of cases, not feel comfortable recreating in the streets, especially if open streets are managed by the police.

This research will enhance the field of transportation planning and engineering by providing practitioners and academics with a detailed qualitative analysis of how a city transportation agency responded to an airborne pandemic. This analysis can be used to supplement further understanding, analysis, and research on how the Covid-19 pandemic has and will continue to shape the nature of our cities. As the current pandemic has

coincided with equity discussions, the equity maps provide transportation practitioners with a quantitative visualization of how much or little support they provide their vulnerable populations. Since these vulnerable populations are designated by criteria from each respective case study city, the analysis serves as a context-specific visualization to hopefully better serve that specific city. Other cities which are not included in this research can easily use the provided maps as templates to make their own maps in order to visualize and better understand where their projects are and are not supporting various residents.

It is currently unclear how much the projects unique to Covid-19 or accelerated because of Covid-19 will change the direction of how a city progresses into the future. One can only speculate, as some city workers have done, that these projects will indeed accelerate a city's plans to expand networks for walking, biking, and other active modes of transportation, as well as create more spaces in cities and towns outside of homes for people to gather. Cities are aware that Covid-19 will most likely not be the last airborne pandemic in our lifetimes, and a pandemic can help a city change for the better, as several pandemics have made positive contributions to a city's direction historically. Cities and businesses are currently economically struggling while streets are being opened to people and certain kinds of bike and pedestrian projects are being accelerated. Cities will continue to see downstream effects of Covid-19, manifested through permanent Slow Streets or expanded outdoor dining or, unfortunately, through financial constraints, for years to come. It is up to transportation practitioners, academics, students, and any interested person to guide our cities to be evolved iterations of themselves: places where wide sidewalks, slow residential streets, outdoor dining, and protected bicycle facilities are the norm.

REFERENCES

-
- ¹ Plumer, Brad. “Cars take up way too much space in cities. New technology could change that.” Vox. 26 Sept. 2020. <https://www.vox.com/a/new-economy-future/cars-cities-technologies>
- ² “Deciding to go out.” CDC. 28 Oct. 2020. <https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/deciding-to-go-out.html#:~:text=COVID%2D19%20spreads%20easier%20between,people%20a part%20are%20more%20risky.>
- ³ Brinkley, Catherine. “How Have Pandemics Historically Changed Cities?” UC Davis. 19 May 2020. <https://www.ucdavis.edu/curiosity-gap/how-have-pandemics-historically-changed-cities/>
- ⁴ Lydon, Mike (2012). Tactical Urbanism Vol. 2.: “Short-term action, long-term change.” https://issuu.com/streetplanscollaborative/docs/tactical_urbanism_vol_2_final?e=4528751/2585800.
- ⁵ Hanson, Melinda & Majed Abdulsamad. Global Designing Cities Initiative. “From pop-up to permanent: five lessons in tactical urbanism.” Published 18 April 2020. <https://globaldesigningcities.org/2018/04/18/from-pop-up-to-permanent-five-lessons-in-tactical-urbanism/>
- ⁶ “Phasing and Interim Strategies.” Global Designing Cities Initiative. <https://globaldesigningcities.org/publication/global-street-design-guide/shaping-streets/phasing-interim-strategies/>
- ⁷ NACTO & GDCI. *Streets for Pandemic Response and Recovery*. Published 21 May 2020. https://nacto.org/wp-content/uploads/2020/06/NACTO_Streets-for-Pandemic-Response-and-Recovery_2020-06-25.pdf
- ⁸ Urban Systems, The Urban Project. *Covid-19 Street Rebalancing Guide*. Published June 2020.
- ⁹ NACTO. “Covid-19: Transportation Resource Center.” https://nacto.org/program/covid19/?mc_cid=dca71f07e7&mc_eid=c60f3a701b#updates
- ¹⁰ Walker, Allssa. ”Cities after coronavirus: Why urbanists are wrong about Covid-19.” 20 May 2020. <https://www.curbed.com/2020/5/20/21263319/coronavirus-future-city-urban-covid-19>
- ¹¹ Atlanta Bicycle Coalition. “Slow streets & physical distancing lanes during Covid-19.”

<https://www.atlantabike.org/slowstreetscovid19?fbclid=IwAR2SG0VqPnP3RQADLnBmrY7u-vyWoY0V33USYuzjCzaWWkzPIX3hUtlWoI4>

- ¹² *Untokening: Mobility Justice and Covid-19*. Published April 2020.
<https://www.untokening.org>
- ¹³ Lydon, Mike. “COVID19 Livable Streets Response Strategies.”
<https://docs.google.com/spreadsheets/d/1tjam1v0NLUWkYedIa4dVOL49pyWIPIyGwRB0DOnm3Ls/edit#gid=0>
- ¹⁴ Landman, Karen and Caleb Okereke. NPR. “Commuting in a pandemic: These health workers are trekking and canoeing.” 29 April 2020.
<https://www.npr.org/sections/goatsandsoda/2020/04/29/841830595/commuting-in-a-pandemic-these-health-workers-are-trekking-and-canoeing>
- ¹⁵ SFMTA “Slow Streets Program.”
<https://www.sfmta.com/projects/slow-streets-program>
- ¹⁶ SFMTA. “Temporary Emergency Transit Lanes: Protecting Muni Customers during Covid-19.” <https://www.sfmta.com/projects/temporary-emergency-transit-lanes#:~:text=Creating%20temporary%20emergency%20transit%20lanes,are%20kept%20out%20of%20traffic.&text=Physical%20distancing%20means%20that%20Muni,pre%2DCOVID%2D19%20levels>.
- ¹⁷ Shared Spaces: Business services. <https://sf.gov/shared-spaces>
- ¹⁸ Tumlin, Jeffrey (jeffreytumlin). “I love the low-key, friendly @SharedSpacesSF of the Sunset.” 22 Nov. 2020, 6:23pm. Twitter.
- ¹⁹ Hake, Shannon. SFMTA. 9 Sept. 2020. Personal communication [Video interview].
- ²⁰ SFMTA. “Slow Streets are Full Steam Ahead.” 5 Oct. 2020.
<https://www.sfmta.com/blog/slow-streets%20are%20full-steam-ahead>
- ²¹ Tumlin, Jeffrey (jeffreytumlin). “Noe St in Duboce Triangle used to be like 14th until former SF Planning Director Allen Jacobs, author of Great Streets, fixed it in the 70s. Now it's a #SlowStreet.” 10 Oct. 2020, 6:09pm. Twitter.
- ²² SFMTA. *Slow Streets Citywide Questionnaire Fact Sheet*. October 2020.
https://www.sfmta.com/sites/default/files/reports-and-documents/2020/10/slow_streets_citywide_questionnaire_-_fact_sheet_october_2020.pdf
- ²³ SFMTA. “Slow Streets Takes it to the Streets.” 4 Nov. 2020.
<https://www.sfmta.com/blog/slow-streets-takes-it-streets>
- ²⁴ San Francisco Health Streets Operations Center. *Tenderloin Neighborhood Plan for*

Covid-19. 6 May 2020. https://sf.gov/sites/default/files/2020-05/Tenderloin_Neighborhood_Plan_May_6_2020.pdf

- ²⁵ SFMTA. “Tenderloin COVID-19 Emergency Streets.” <https://www.sfmta.com/projects/tenderloin-covid-19-emergency-streets>
- ²⁶ Data SF. *Invest In Neighborhoods (IIN) Areas*. 5 Sept. 2019. <https://data.sfgov.org/Economy-and-Community/Invest-In-Neighborhoods-IIN-Areas/h7xa-2xwk>
- ²⁷ OEWD. “Invest In Neighborhoods San Francisco.” <https://oewd.org/neighborhoods>
- ²⁸ Data SF. Equity Strategy Neighborhoods. 5 Sept. 2019. <https://data.sfgov.org/Transportation/Equity-Strategy-Neighborhoods/f8bh-m8ez>
- ²⁹ Portland Bureau of Transportation. “What is the Safe Streets Initiative?” <https://www.portland.gov/transportation/safestreetspd/what-safe-streets-initiative>
- ³⁰ PBOT. “Vision Zero.” <https://www.portlandoregon.gov/transportation/40390>
- ³¹ Falbo, Nick. PBOT. 11 Sept. 2020. Personal communication [Video interview].
- ³² Marx, Michelle. PBOT. 15 Oct. 2020. Personal communication [Phone interview].
- ³³ PBOT. “Safe Streets: Adapting Portland’s Streets for Restarting Public Life.” May 2020. <https://www.portlandoregon.gov/transportation/article/761623>
- ³⁴ PBOT. “*New* Winter Healthy Businesses Permits.” 2 Oct. 2020. https://www.portland.gov/transportation/safestreetspd/what-healthy-businesses-permit?utm_medium=email&utm_source=govdelivery
- ³⁵ PBOT. “Healthy Businesses design requirements and permit conditions.” Oct 2020. [portland.gov/transportation/safestreetspd/healthy-businesses-design-requirements-and-permit-conditions](https://www.portland.gov/transportation/safestreetspd/healthy-businesses-design-requirements-and-permit-conditions)
- ³⁶ PBOT. “Basic traffic control devices and vendors.” https://www.portland.gov/transportation/safestreetspd/basic-traffic-control-devices-and-vendors?_ga=2.172046883.1895229047.1603679893-2008133684.1603132469
- ³⁷ PBOT. “PBOT Equity & Inclusion Community Partnerships.” 2020. <https://www.portland.gov/transportation/justice/pbot-equity-inclusion-community-partnerships>
- ³⁸ PortlandMaps – Open Data. *Vulnerability*. 29 Jan. 2019. <https://gis-pdx.opendata.arcgis.com/datasets/vulnerability>

-
- ³⁹ SDOT. “Stay Healthy Streets.”
<https://www.seattle.gov/transportation/projects-and-programs/programs/stay-healthy-streets>
- ⁴⁰ SDOT. “Stay Healthy Blocks.”
- ⁴¹ Seattle & King County Public Health. “Stay Healthy Business Streets: Guidance for temporary changes to business district street design and use for COVID-19 response and recovery.” 1st ed. 3 Aug. 2020.
- ⁴² SDOT blog. “We’ve completed pedestrian-first crosswalk safety goal six months early and are advancing a new policy to create more automatic walk signals and give people more time to cross the street.” 23 July 2020.
<https://sdotblog.seattle.gov/2020/07/23/weve-completed-pedestrian-first-crosswalk-safety-goal-six-months-early-and-are-advancing-a-new-policy-to-create-more-automatic-walk-signals-and-give-people-more-time-to-cross-the-street/>
- ⁴³ Downtown Seattle Association. “Strategic Plan 2016-2020.”
<https://downtownseattle.org/about/strategic-plan/>
- ⁴⁴ Seattle.gov. “Imagine Greater Downtown: Big ideas for the heart of Seattle.”
https://www.seattle.gov/Documents/Departments/SDOT/PlanningProgram/IGD_Full%20Plan_ADA.pdf
- ⁴⁵ SDOT blog. “Three miles of Lake Washington Blvd will stay open to people walking, rolling, and biking until the week of Oct. 5.” 4 Sept. 2020.
<https://sdotblog.seattle.gov/2020/09/04/three-miles-of-lake-washington-blvd-will-stay-open-to-people-walking-rolling-and-biking-until-the-week-of-oct-5/>
- ⁴⁶ SDOT blog. “Seattle takes new steps to fine-tune traffic signals for people walking and rolling during COVID-19 health crisis.” 7 May 2020.
<https://sdotblog.seattle.gov/2020/05/07/seattle-takes-new-steps-to-fine-tune-traffic-signals-for-people-walking-and-rolling-during-covid-19-health-crisis/>
- ⁴⁷ Frazier, Jonathan. SDOT. 10 Sept. 2020. Personal communication [Video interview].
- ⁴⁸ Gruber, Jacqueline. DSA. 26 Oct. 2020. Personal communication [Phone interview].
- ⁴⁹ SDOT. “Outdoor Permitting for Restaurants, Food Trucks and Carts, and Retail Stores.” <http://www.seattle.gov/office-of-economic-development/covid-19/outdoor-permit>
- ⁵⁰ Seattle City Planning GIS. *Racial and Social Equity Composite Index*. 15 Jan. 2020.

<https://www.arcgis.com/home/item.html?id=225a4c2c50e94f2cb548a046217f49f7>

- ⁵¹ SDOT. “Stay Healthy Streets.”
<https://www.seattle.gov/transportation/projects-and-programs/programs/stay-healthy-streets>
- ⁵² Trumm, Doug. The Urbanist. “Stay Healthy Streets. 17 Apr. 2020.
<https://www.theurbanist.org/2020/04/17/stay-healthy-streets/>
- ⁵³ City of Toronto. “Covid-10: ActiveTO.” 2 Nov. 2020.
<https://www.toronto.ca/home/covid-19/covid-19-protect-yourself-others/covid-19-reduce-virus-spread/covid-19-activeto/>
- ⁵⁴ City of Toronto. “Covid-19: ActiveTO – Quiet Streets.” 2 Nov. 2020.
<https://www.toronto.ca/home/covid-19/covid-19-protect-yourself-others/covid-19-reduce-virus-spread/covid-19-activeto/covid-19-activeto-quiet-streets/>
- ⁵⁵ City of Toronto. “Covid-19: ActiveTO – Closing Major Roads.” 27 Oct. 2020.
<https://www.toronto.ca/home/covid-19/covid-19-protect-yourself-others/covid-19-reduce-virus-spread/covid-19-activeto/covid-19-activeto-closing-major-roads/>
- ⁵⁶ City of Toronto. “Covid-19: ActiveTO – Expanding the Cycling Network.” 26 June 2020. <https://www.toronto.ca/home/covid-19/covid-19-protect-yourself-others/covid-19-reduce-virus-spread/covid-19-activeto/covid-19-activeto-expanding-the-cycling-network/>
- ⁵⁷ City of Toronto. “Covid-19: CaféTO.” 30 Oct. 2020.
<https://www.toronto.ca/home/covid-19/covid-19-protect-yourself-others/covid-19-reduce-virus-spread/covid-19-cafeto/>
- ⁵⁸ Katz, Becky. City of Toronto Transportation Services. Cycling and Pedestrian Manager. 2 Nov. 2020. Personal communication [Phone interview].
- ⁵⁹ City of Toronto. “ActiveTO delivers 65 kilometres of Quiet Streets along 32 neighbourhood routes across Toronto.” 10 June 2020.
<https://www.toronto.ca/news/activeto-delivers-65-kilometres-of-quiet-streets-along-32-neighbourhood-routes-across-toronto/>
- ⁶⁰ Toronto Open Data. “Wellbeing Toronto - Civics and Equity Indicators.” *31 Dec. 2014*. <https://open.toronto.ca/dataset/wellbeing-toronto-civics-equity-indicators/>
- ⁶¹ City of Toronto. “About Wellbeing Toronto.”
<https://www.toronto.ca/city-government/data-research-maps/neighbourhoods-communities/wellbeing-toronto/about-wellbeing-toronto/>